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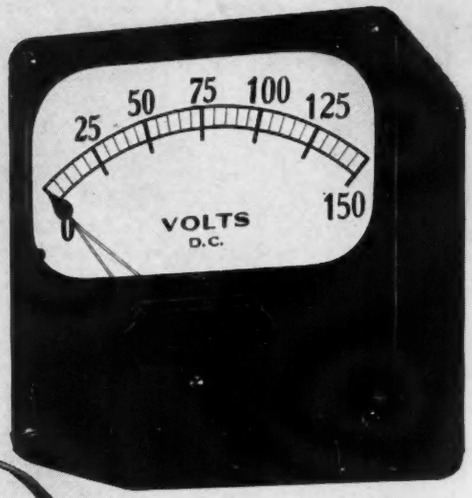

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*November 16, 1940*

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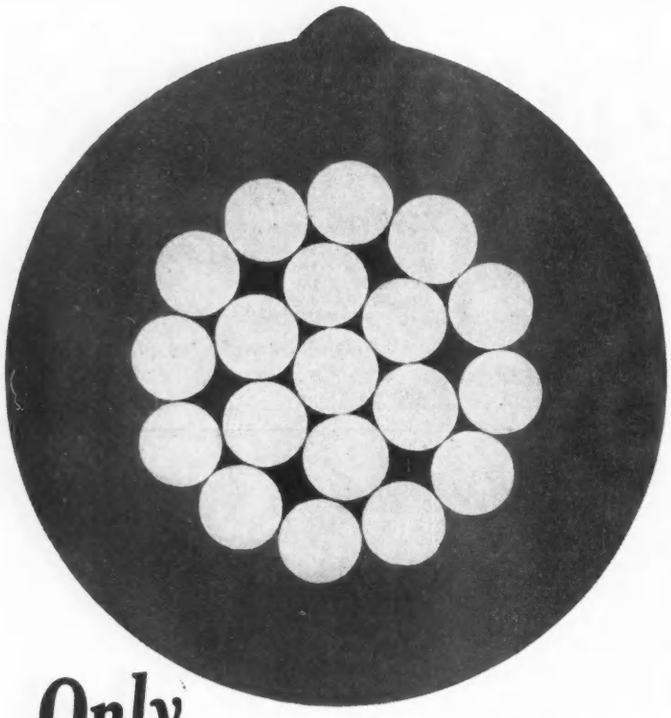
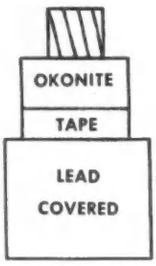
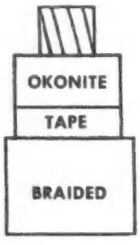


# Only TIME CAN TELL the True Value of OKONITE INSULATION

**43 YEARS AFTER INSTALLATION** as building wire in New Jersey, plain, unprotected Okonite showed 659 lbs. tensile strength.

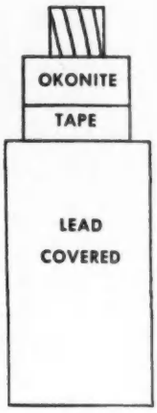



**32 YEARS AFTER INSTALLATION** as communication cables in Honolulu, lead covered Okonite still had a tensile strength of 1,450 lbs. and a 10.7″ elongation (better than guaranteed standard for new wire).



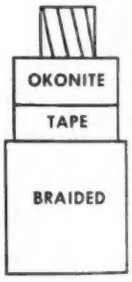

**25 YEARS AFTER INSTALLATION** as Railroad Signal Cable in Pennsylvania, tape and braid finished Okonite tested 825 lbs. tensile and 5.5″ elongation.

**24 YEARS AFTER INSTALLATION** as railroad jumper cable in New York, tape and jute-covered Okonite tested 1,051 lbs. tensile and 10.5″ elongation.




**16 YEARS AFTER INSTALLATION** as 6,600 volt power cable in ducts in Connecticut, lead-covered Okonite had a tensile strength of 1,245 lbs. and elongation of 9.9″ (equal to standards for new Okonite and superior to A.S.T.M. Grade A requirements for new wire).

Note: *After tests, the cable was returned to service and now — 10 years later is still delivering power.*




**16 YEARS AFTER INSTALLATION** in Hawaii as signal wire in trunking under adverse tropical conditions, braid covered Okonite showed a tensile strength of 1,048 lbs. and an elongation of 9.5″.

*No tests so far developed can predict the long, trouble free life which the Okonite process builds into Okonite wires and cables. That is why we say, "Okonite Quality Cannot be Written into a Specification." The Okonite Co., Passaic, N. J., offices in principal cities.*

**OKONITE INSULATION**

# The Next Four Years

What will be the effect upon private electric utilities of the Roosevelt victory on November 5? Does it mean a new wave of drastic regulation, a new spurt in public ownership, a new crusade against electric rates, new taxes? These questions naturally are occupying the attention of those who work for utilities as well as those who furnish the power companies with equipment and supplies.

To take a pessimistic view of the situation would perhaps be easy, but adherence to that kind of thinking would be nothing short of suicide. While undoubtedly the Administration and its agencies will strive for certain things that will be bitter pills for some utility men, it is our opinion that the outcome will be far less unpalatable if the executives of the industry take a more conciliatory and co-operative attitude toward some of these inevitables.

The first four years of the New Deal was characterized by attack on the utilities, culminating in the holding company act, with extraordinary regulatory powers to the Securities and Exchange Commission and the Federal Power Commission. The second term saw an effort to harass private ownership through the yardstick, competition, loans and grants for municipal ownership, higher taxes and attacks on rates. Then a reaction set in against confiscation of property and subsidized competition.

As we enter the era of the third term the indications are that the government will not compete with private utilities, but where it wants a territory it will purchase, without dismemberment, the utility systems in that area. The indications are also that the subsidizing of municipal ownership through loans and grants will not meet with a sympathetic Congress.

In our opinion, the New Deal in the next four years will try to make effective the legislation now on the books, as well as the proposals made during the second term. The holding company act, for instance, has been on the books for more than five years without integration yet becoming effective. There is every reason to believe that SEC will now move ahead to enforce the law with the greatest speed. Between what the SEC might propose and what the holding companies would like is a middle ground. The sooner this is recognized and an honest effort made to reach a reasonably acceptable adjudication the quicker will the patient recover.

Likewise, there are proposals for interconnection, for deferred depreciation, for financing policies involving greater diversity of ownership, all of which can be solved without too great delay if a little understanding of human nature would permeate the minds of men.

As for higher taxes, the utilities will undoubtedly share the same fate as all other business. The problem from now on will be how to pass these taxes on to the consumer.

Rates might be forced down further, although one should not lose sight of the fact that higher costs and the need for more tax revenues might prove a deterrent.

For the past eight years the utilities and the government have been in conflict. There will be no need for it to continue for another four years if both sides will agree to the principle of give and take.

# Potential Transformers Tested in Service

*More economical than laboratory tests — Actual burdens used — Customer service not interrupted — Check obtained on local factors affecting meter performance — Transformer stock minimized*

*WALTER C. WAGNER, General Superintendent Meter Division, Philadelphia Electric Company*

**METERMEN test primary voltage transformers in the field with this equipment. The equipment developed for 2,300-volt testing comprises a standard potential transformer, an exciting transformer, a portable voltmeter, the comparator voltmeter, connecting leads, auxiliary safety equipment, and the carrying cases.**

PERIODIC TESTING of potential transformers in service has a number of advantages over returning them for test in the laboratory. The testing of a transformer in service, with its burden of connected wiring, switches and other associated equipment in place, assures meter accuracy under actual operating conditions. Such testing provides a check on the existence of loose connections and other irregularities that affect meter performance. In addition to substantial savings in the cost of testing, it eliminates the need for an increased stock of spare transformers of various sizes and types. Where continuity of service is of sufficient importance to a customer, the transformers can be tested safely in service without interruption of energy supply, even at the higher voltages.

Service testing of potential transformers on customers' premises on the Philadelphia Electric Company system was initiated in January, 1940, on two-phase and three-phase circuits operating at 2,300 volts. At this voltage it was found feasible to adopt the practice of performing the tests without interrupting service. Apparatus and method were developed for making these tests safely and efficiently.

In setting up the service testing program, available methods were investigated with a view to the selection of a precision method requiring a minimum of test equipment. The portable null potential transformer testing set and the comparator voltmeter were the two precision methods which appeared to have greatest promise for this purpose. Although the null method long ago supplanted the comparator voltmeter method for laboratory testing, chiefly because the former was direct reading for ratio and phase-angle difference, the comparator voltmeter was selected for field work.

Comparator voltmeter tests on representative 2,300-volt potential transformers indicated that the ac-

curacy of results compared favorably with data obtained by the null method. The comparator voltmeter itself is a rugged, high-precision, center-zero dynamometer voltmeter with a separately excited field winding. The instrument has a uniform scale and measures small voltages accurately.

To make the test the primary winding of a standard transformer is connected in parallel with the primary of the transformer under test, the secondary of the standard transformer is connected to oppose the secondary of the transformer under test and the response element of the comparator voltmeter is connected to measure the small difference between the secondary voltages.

### *New Design Developed*

Excitation of the comparator voltmeter field winding from the same phase permits an accurate determination of transformer ratio. This ratio can be obtained from the test data by calculation from the standard formula or by reference to a simple tabular chart.

Phase angle is determined by exciting the comparator voltmeter field winding in phase quadrature with the potential of the transformer under test. On two-phase circuits this may readily be obtained by connection to the other phase, and on three-phase circuits a slight modification of the test procedure gives the desired results.

The comparator voltmeter in present use for this program is the Weston Model 333. A new design, in which the price, size and weight have been greatly reduced, without reducing accuracy below desired limits, has been developed for this work by the Weston Electrical Instrument Corporation.

Results of 300 periodic ratio tests to date of 2,300-volt potential transformers in service, in terms of change from the results of previous laboratory tests on the same transformers, showed that 97 per cent were within 0.4 per cent and 84 per cent within 0.2 per cent of the ratios observed previously. It was found that the existing burdens in a few instances were not the same as originally assumed. This fact probably accounts for some of the differences disclosed by the tests.

In so far as phase angle may be related to meter-transformer performance, extensive test experience over many years has shown that potential transformers developing an appreciable change in phase angle have associated differences in ratio, and such transformers would be found by means of the ratio test, thus dispensing in general with the need for phase angle tests.

**TYPICAL TEST SETUP** for checking voltage transformers in service on customer's premises

### *Stable Phase Angles*

The phase angles of most of the transformers tested were found to be unchanged within the $\pm 5$ minute accuracy limit of the test equipment. The phase angle of only two transformers were found to differ by more than ten minutes, the actual changes in these cases being $+11$ and $+14$ minutes respectively. Such phase angle differences have small effect on meter accuracy at commercial power factors.

During these 2,300-volt tests, in which all wiring, switches and apparatus on the meter potential supply circuits were included, two cases having poor connections appreciably affecting metering performance were detected by this method of test. It is unlikely that the conditions would have been discovered except by these tests.

In addition to the other advantages enumerated, testing of the 300 2,300-volt potential transformers in service per year instead of removing them for laboratory test will result in a saving of the order of $3,000 annually. The two men averaged ten to twelve transformers tested per day.

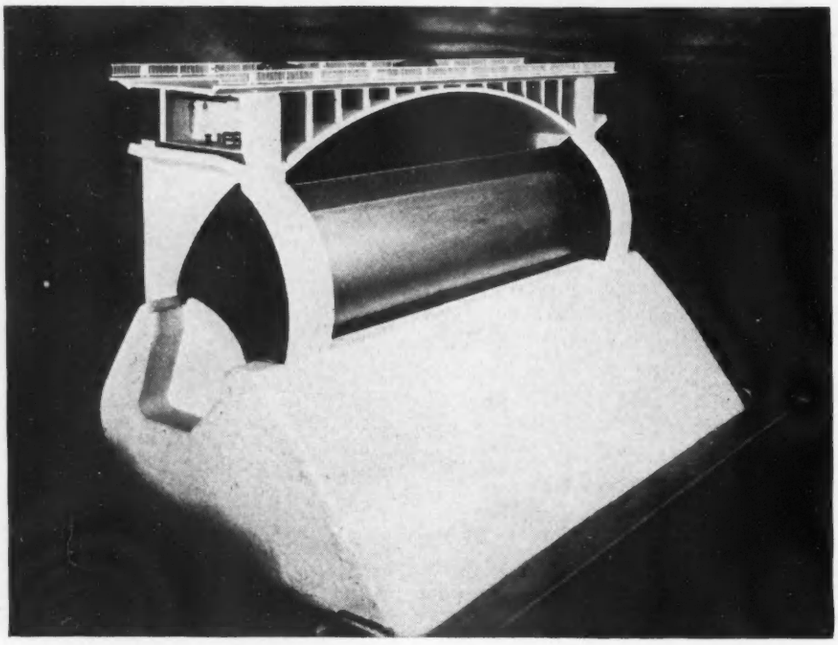
**TWO MEN** readily transport the equipment for field testing of metering voltage transformers

Plans are under consideration to expand the service-testing program to include potential transformers operating at line-to-neutral voltages up to and including 132 kv. The advantages and economies of service testing are expected to be equally effective at the higher voltages. Methods are being studied for performing such tests without interrupting service, in cases where such procedure might be required.

# Induction Heating for Drum Gates

*Means of preventing freezing in 115x28-ft. gates developed by test — Each of eleven gates to require 215 kva. — Induction in iron to yield 78 per cent of total heat*

*RALPH D. GOODRICH, Jr., U. S. Bureau of Reclamation, Denver, Colo.*



**MODEL of drum gate at Grand Coulee**

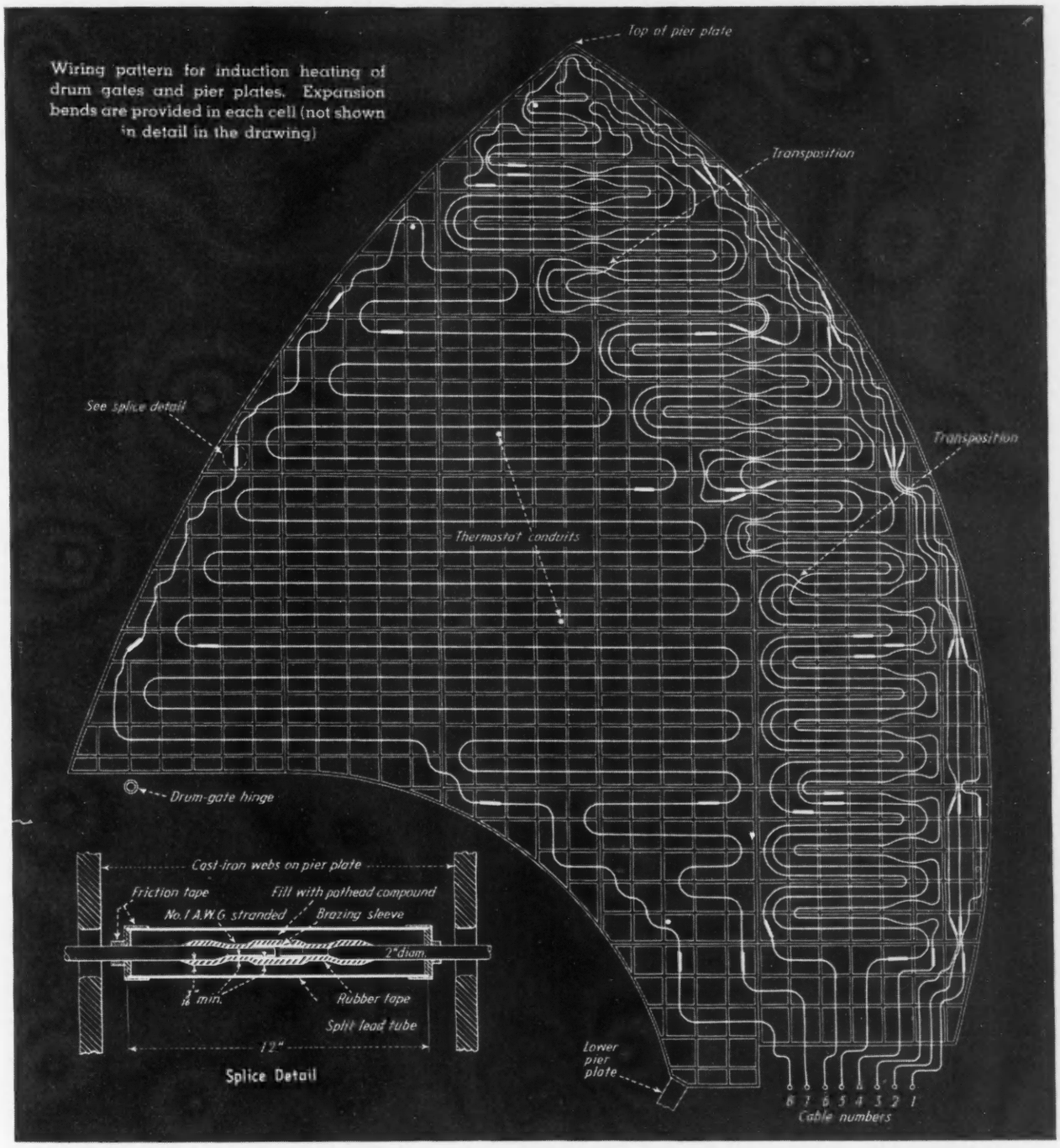
CONTROL of the reservoir water level at Grand Coulee Dam on the Columbia River in northern Washington is provided by eleven drum gates. Temperatures as low as 28 deg. F. below zero have been recorded in this locality, and because of anticipated operating conditions it was necessary to prevent ice accumulation and freezing of the gates. A permanent heating system for de-icing was considered desirable and various methods, including electrical resistance heaters and the circulation of hot liquids, were investigated. Heating by induced eddy currents was eventually favored because of the simplicity and permanence of the installation, but extensive tests were necessary to furnish data on which the designs could be based.

The eleven gates at Coulee are each 115 ft. long and 28 ft. high and recede into chambers in the spillway, making a smooth profile over the crest of the dam. In partially or fully raised position the gate floats on water in the gate chamber, which is under pressure from the water in the reservoir. A horizontal hinge on the upstream side of the gate holds it in place and allows it to swing from one position to another. Seals on each end of the gate and on the upstream and downstream sides of the chamber minimize water leakage. The end seals bear against the metal pier plates and the chamber seals form close contacts with the skin plates on the gate. An overhanging lip or apron on the downstream side of each gate, shown in the picture of the gate model, rests on the metal gate seat which supports part of the weight of the gate.

### *Induction Heating*

Briefly, heating by induction consists of passing an alternating current through a conductor which is threaded through holes in masses of iron. The current sets up magnetic flux in the iron around each hole and the flux in turn generates currents in the iron. In the Grand Coulee installation 78 per cent of the total heat is developed in the iron. By causing most of the heat to be developed directly in the iron in contact with the ice heat transfer from the cable is minimized and the operating temperature of the copper cable is kept much lower than it would be in a straight resistance unit.

Although the same general scheme was used for heating both the pier plates and gate seats, the specific applications in the two cases were different. For the pier plate installation it was necessary to thread the copper cables through holes in the reinforcing webs on the back of the cast-iron plates. After threading, the cables are imbedded directly in contact with the concrete. The heater cables of this portion of the installation are therefore irreplaceable, and in order to insure long life the insulation used in them is much heavier than would ordinarily be required. The presence of water indicated the use of moisture-




**PROCEDURE for making splice shown in detail above**

1. Thread one end washer on each cable, after stripping tape back 8 in.

1a. On vertical splices also thread three of the brass rings provided on one cable for each splice.

2. Strip 2 in. of insulation from end of each cable, tapering the end of remaining insulation for a distance of about 1/2 in.

3. Place ends of cables in brazing sleeve, making sure that sleeve is centered on both conductors within 1/16 in.

4. Protect insulation by placing temporary sheet asbestos shields on cable adjacent to brazing sleeve, and wrapping cable behind shields with wet rags.

5. Braze splice, using 22 in. of 1/8 in. diameter low melting point brazing rod, and keeping rags wet during brazing.

6. Remove rags and shields, and dry the splice.

7. Thoroughly clean 2 1/2 in. of insulation adjacent to the ends with coarse emery cloth and apply two coats of rubber cement.

8. Wrap splice tightly with half-lapped special waterproof rubber tape.

9. Bind the loose end of rubber tape with two wraps of friction tape.

10. Assemble lead tube and end washers, making sure that tube is properly centered over splice (and that pouring slot is up, on horizontal splices). Hold end washers in place by wrapping friction tape on cable outside of washers. Also wrap friction tape around ends of lead tube to hold it in place.

10a. On vertical splices reinforce inside of lead tube, with three brass rings (see 1a), and wrap friction tape over whole tube to retain pothead compound in tube.

11. Preheat tube to at least 150 deg. F. and then fill with pothead compound at approximately 300 deg. F. pouring temperature. Keep splicing sleeve heated until compound has flowed to all parts and completely filled sleeve.

resistant rubber, such as is used in submarine power cables.

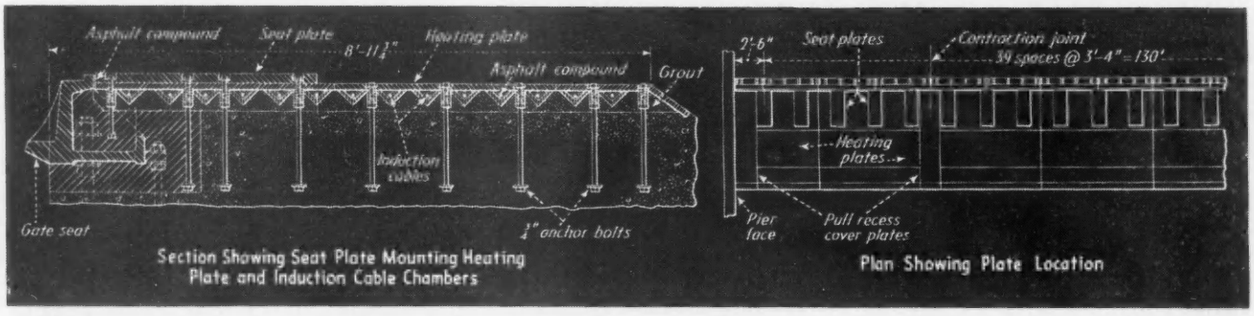
It will be noticed in an accompanying illustration that part of the pier plate is heated by three cables, while the remainder is heated by only one. The former part is traversed by the overhanging apron on the downstream side and is normally exposed to the air. This section requires 70 watts of heat per square foot of surface to maintain a temperature of 32 deg. F. when the air temperature is 28 below zero, the recorded minimum. The rest of the plate is protected by the end of the drum gate when the gate is raised and would become overheated if the same amount of heat were applied. Designs allow for application of maximum heat when the gate is lowered, and the entire plate is exposed, by providing a double-throw switch so that either full or half voltage may be used.

The heating system of the gate seat was made replaceable by welding angle irons to the underside of each heating plate. The raceway formed by these angles is triangular in shape, and after the concrete has set the plates and angles may be removed, if necessary. The induction heating cables are threaded through the raceway, which is afterward filled with asphalt to improve the heat transmission.

### *Samples Tested*

In view of the fact that heating by eddy currents is rather complicated to analyze mathematically, designs are based on tests conducted on full-sized samples of the pier and gate seat plates. Initial measurements of eddy-current losses in an iron test ring were deemed unsatisfactory when it was found that the power losses in the supply circuit alone were very nearly the same as the losses in supply circuit and ring together. The error introduced by subtracting these quantities was excessive. To segregate the eddy current losses separate measurements were made by winding 100-turn test coils around typical webs of each type on a full-sized sample pier plate. This sample was 6 ft. 3 in. square with 1-in. reinforcing webs crossing the plate both horizontally and vertically at 15-in. intervals. Each test coil linked all the flux that passed through its web, and consequently had the same voltage, in a 100-to-1 ratio, induced in it that was induced in the web. It was possible, therefore, to measure the power loss in the web by means of a wattmeter connected to the test coil and to the copper cable.

Gate seat tests were conducted using a similar coil, but in this instance only a 1-ft. length of plate was used, as the same results are produced by the continuous iron circuit around the cable, regardless of length.




**PARTIAL PLAN AND SECTION showing heating plates along spillway ledge**

### *Rubber Insulated Cables*

Computations based on these tests indicated that about 215 kva. at 50 volts, 60 cycles, 80 per cent lagging power factor would be required to heat all of the necessary surfaces of one drum gate. All the heater cables are No. 1 AWG, 37 strand, with 10/64-in. moisture-resistant rubber insulation, through which 250 amp. will be circulated. Although this value of current considerably exceeds the recommended ampere rating for this size of cable in conduits, tests indicate that due to the favorable heat-conducting conditions this current can be safely carried continuously without excessive temperature.

Power is supplied through 6,900- to 50-volt, 60-cycle transformers, especially designed for this service. A total of 22 transformers are used—two for each gate—with high flash-point non-inflammable cooling liquid specified to reduce fire hazard. To allow for variations between actual results and tests, and weather colder than anticipated, seven $2\frac{1}{2}$ per cent primary taps are included on each transformer, giving a $17\frac{1}{2}$ per cent range in voltage on the secondary.

### *Control Equipment*

Protective and control equipment is designed to withstand the expected high humidity in the galleries of the dam. A submarine-type breaker was specified in the design for the 6,900-volt circuit breaker connected to the primary of each transformer. It is manually controlled, with a shunt-trip coil for automatic tripping. Thermostats controlling automatic tripping are equipped with sealed mercury switches, to improve the dependability under conditions of high humidity. The thermostats themselves serve to protect against excessive temperatures in the concrete near the heated surfaces.

The adopted safe maximum temperature of the concrete is 150 deg. F., and to allow a liberal safety factor the thermostats are adjusted to trip the breakers at 125 deg. An additional safeguard is provided by equipping the thermostats with manual resets, so that after tripping the breaker cannot be reclosed until the operator has reset the thermostat. Automatic resetting of the thermostats would permit the breaker to be closed as soon as the heating circuit had cooled off, without attention being called to the original trouble. Power for the tripping circuit is taken from the secondary of the transformer, and after the breaker opens the control circuit is cut off, to prevent overheating the trip coil.

Each switchboard is located next to the associated transformer and

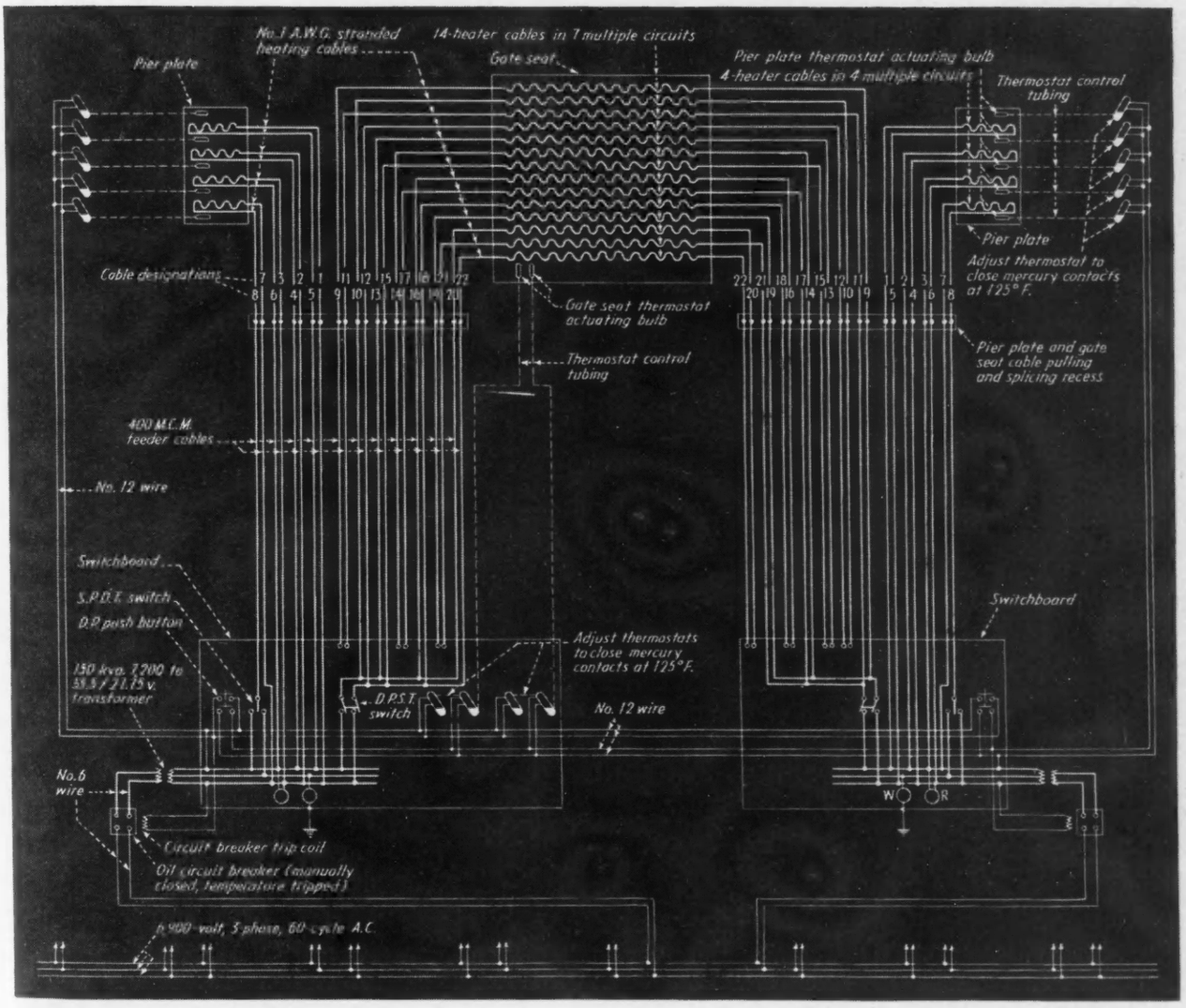
connected to it by a bus capable of carrying 3,000 amp. The switchboard contains a single-pole, double-throw switch for transferring the pier plate circuit mentioned above from half to full voltage, a double-pole, single-throw switch for disconnecting all of the gate seat circuits when the gate is lowered, a red lamp to indicate when the transformer is energized and a white lamp to indicate when a heating circuit is grounded and to drain static charges from the secondary circuits.

### *Heat in the Iron*

Main advantage of heating by induction is that the greater part of the heat is generated directly in the iron which is to be heated. This eliminates most of the problem of heat transfer, makes possible lower temperatures in the copper cable and reduces the danger of overheating the concrete portions of the dam. Aside from the power supply and control equipment, the only installation required is threading of the heater cable. The control equipment described could be used with any type of heating installation, and simplicity of design was emphasized in order to keep down the high maintenance costs, normally associated with complicated circuits.

So far as is known, no previous designs using induction heating have been made. Because of the importance of the installation considerable time has been spent on the design and tests will be conducted during construction to insure that the heater cable is not damaged before the system is put in operation. Field tests will be conducted as soon as possible to check the predicted values.

The heating system was designed under the direction of H. H. Plumb, electrical engineer. All electrical designs are made under the general direction of H. F. McPhail, assistant chief electrical engineer, and L. N. McClellan, chief electrical engineer. All engineering designs are under the general direction of J. L. Savage, chief designing engineer, and all engineering and construction work is under the general direction of S. O. Harper, acting chief engineer, of Denver, Colo. All activities of the bureau are under the general charge of John C. Page, commissioner, of Washington, D. C.


No. 1 A.W.G. stranded heating cables
14-heater cables in 7 multiple circuits
Pier plate
Gate seat
Pier plate thermostat actuating bulb
4-heater cables in 4 multiple circuits
Thermostat control tubing
Pier plate
Adjust thermostat to close mercury contacts at 125° F.
Cable designations
7 13 12 1 11 12 15 17 18 21 22
8 6 4 5 9 10 13 14 16 19 20
22 21 18 17 15 12 11
20 19 16 14 13 10 9
1 2 3 7
5 4 6 8
Gate seat thermostat actuating bulb
Thermostat control tubing
Pier plate and gate seat cable pulling and splicing recess
400 M.C.M. feeder cables
No. 12 wire
Switchboard
S.P.D.T. switch
D.P. push button
150 kva. 7,200 to 55.5 / 27.75 v. transformer
D.P.S.T. switch
Adjust thermostats to close mercury contacts at 125° F.
No. 12 wire
Switchboard
No. 6 wire
W
R
Circuit breaker trip coil
Oil circuit breaker (manually closed, temperature tripped)
6,900-volt, 3-phase, 60-cycle A.C.

**WIRING DIAGRAM for the heating installation**
Cables 1, 2 and 3 connect to same polarity. Cables 1-6 are permanently connected to transformer and controlled by 6.9-kv. breaker. Cables 7 and 8 are connected to a S.P.D.T. switch so either half or full voltage may be applied. The 48-volt, 60-cycle trip coil on each 6,900-volt breaker is energized to trip the breaker by: (a) closure of any thermostat switch on the corresponding pier plate: (b) closure of either thermostat switch on the gate seat, which trips both breakers simultaneously; (c) push button on switchboard, which trips both breakers simultaneously. In a and b, breaker cannot be reclosed until thermostat is reset manually.

resistant rubber, such as is used in submarine power cables.

It will be noticed in an accompanying illustration that part of the pier plate is heated by three cables, while the remainder is heated by only one. The former part is traversed by the overhanging apron on the downstream side and is normally exposed to the air. This section requires 70 watts of heat per square foot of surface to maintain a temperature of 32 deg. F. when the air temperature is 28 below zero, the recorded minimum. The rest of the plate is protected by the end of the drum gate when the gate is raised and would become overheated if the same amount of heat were applied. Designs allow for application of maximum heat when the gate is lowered, and the entire plate is exposed, by providing a double-throw switch so that either full or half voltage may be used.

The heating system of the gate seat was made replaceable by welding angle irons to the underside of each heating plate. The raceway formed by these angles is triangular in shape, and after the concrete has set the plates and angles may be removed, if necessary. The induction heating cables are threaded through the raceway, which is afterward filled with asphalt to improve the heat transmission.

### *Samples Tested*

In view of the fact that heating by eddy currents is rather complicated to analyze mathematically, designs are based on tests conducted on full-sized samples of the pier and gate seat plates. Initial measurements of eddy-current losses in an iron test ring were deemed unsatisfactory when it was found that the power losses in the supply circuit alone were very nearly the same as the losses in supply circuit and ring together. The error introduced by subtracting these quantities was excessive. To segregate the eddy current losses separate measurements were made by winding 100-turn test coils around typical webs of each type on a full-sized sample pier plate. This sample was 6 ft. 3 in. square with 1-in. reinforcing webs crossing the plate both horizontally and vertically at 15-in. intervals. Each test coil linked all the flux that passed through its web, and consequently had the same voltage, in a 100-to-1 ratio, induced in it that was induced in the web. It was possible, therefore, to measure the power loss in the web by means of a wattmeter connected to the test coil and to the copper cable.

Gate seat tests were conducted using a similar coil, but in this instance only a 1-ft. length of plate was used, as the same results are produced by the continuous iron circuit around the cable, regardless of length.

### *Rubber Insulated Cables*

Computations based on these tests indicated that about 215 kva. at 50 volts, 60 cycles, 80 per cent lagging power factor would be required to heat all of the necessary surfaces of one drum gate. All the heater cables are No. 1 AWG, 37 strand, with 10/64-in. moisture-resistant rubber insulation, through which 250 amp. will be circulated. Although this value of current considerably exceeds the recommended ampere rating for this size of cable in conduits, tests indicate that due to the favorable heat-conducting conditions this current can be safely carried continuously without excessive temperature.

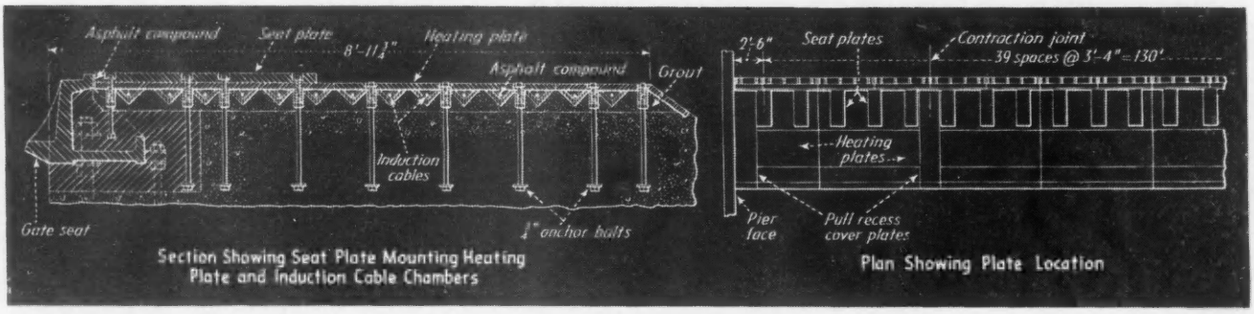
Power is supplied through 6,900- to 50-volt, 60-cycle transformers, especially designed for this service. A total of 22 transformers are used—two for each gate—with high flash-point non-inflammable cooling liquid specified to reduce fire hazard. To allow for variations between actual results and tests, and weather colder than anticipated, seven $2\frac{1}{2}$ per cent primary taps are included on each transformer, giving a $17\frac{1}{2}$ per cent range in voltage on the secondary.

### *Control Equipment*

Protective and control equipment is designed to withstand the expected high humidity in the galleries of the dam. A submarine-type breaker was specified in the design for the 6,900-volt circuit breaker connected to the primary of each transformer. It is manually controlled, with a shunt-trip coil for automatic tripping. Thermostats controlling automatic tripping are equipped with sealed mercury switches, to improve the dependability under conditions of high humidity. The thermostats themselves serve to protect against excessive temperatures in the concrete near the heated surfaces.

The adopted safe maximum temperature of the concrete is 150 deg. F., and to allow a liberal safety factor the thermostats are adjusted to trip the breakers at 125 deg. An additional safeguard is provided by equipping the thermostats with manual resets, so that after tripping the breaker cannot be reclosed until the operator has reset the thermostat. Automatic resetting of the thermostats would permit the breaker to be closed as soon as the heating circuit had cooled off, without attention being called to the original trouble. Power for the tripping circuit is taken from the secondary of the transformer, and after the breaker opens the control circuit is cut off, to prevent overheating the trip coil.

Each switchboard is located next to the associated transformer and




**PARTIAL PLAN AND SECTION showing heating plates along spillway ledge**

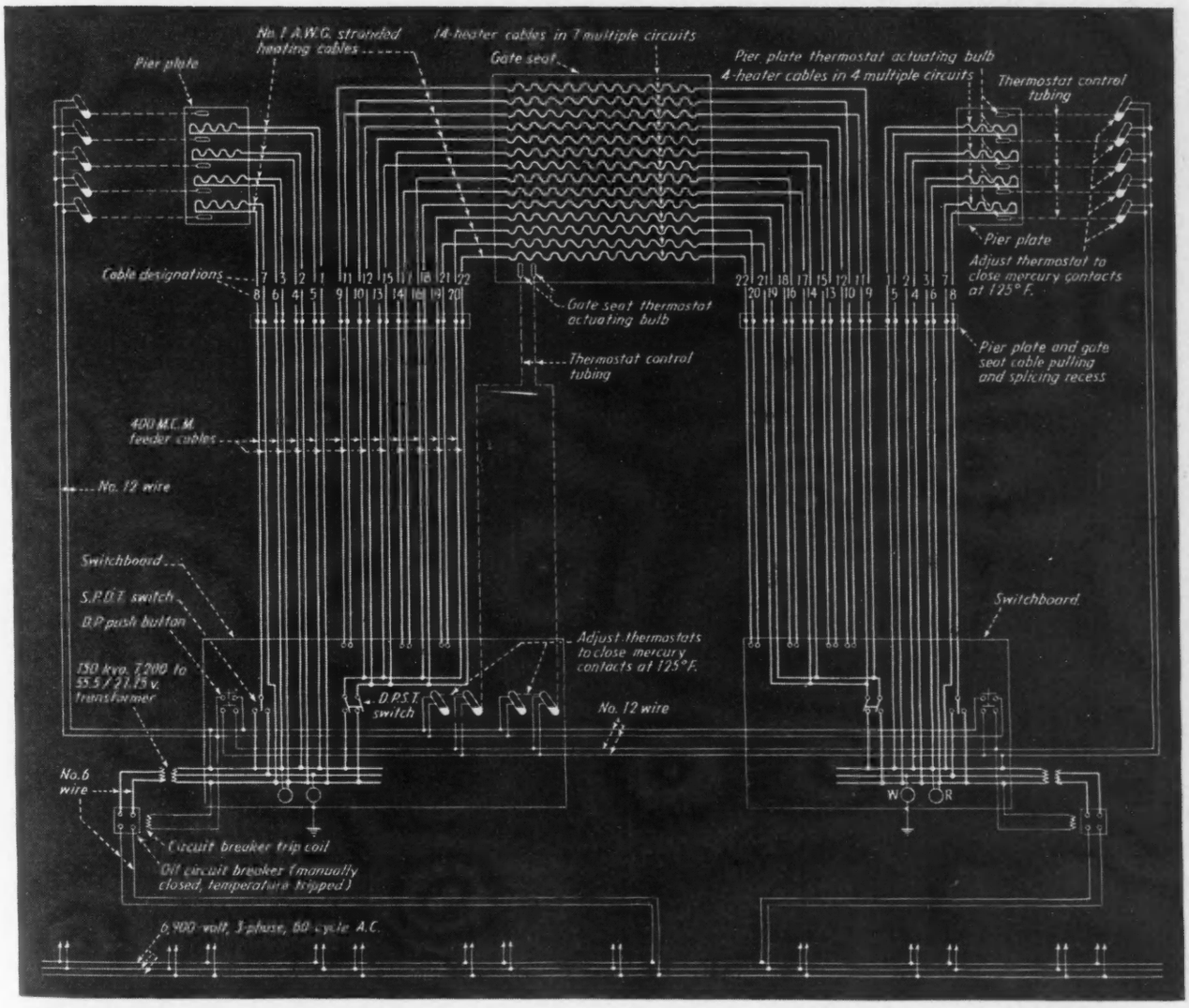
connected to it by a bus capable of carrying 3,000 amp. The switchboard contains a single-pole, double-throw switch for transferring the pier plate circuit mentioned above from half to full voltage, a double-pole, single-throw switch for disconnecting all of the gate seat circuits when the gate is lowered, a red lamp to indicate when the transformer is energized and a white lamp to indicate when a heating circuit is grounded and to drain static charges from the secondary circuits.

### *Heat in the Iron*

Main advantage of heating by induction is that the greater part of the heat is generated directly in the iron which is to be heated. This eliminates most of the problem of heat transfer, makes possible lower temperatures in the copper cable and reduces the danger of overheating the concrete portions of the dam. Aside from the power supply and control equipment, the only installation required is threading of the heater cable. The control equipment described could be used with any type of heating installation, and simplicity of design was emphasized in order to keep down the high maintenance costs, normally associated with complicated circuits.

So far as is known, no previous designs using induction heating have been made. Because of the importance of the installation considerable time has been spent on the design and tests will be conducted during construction to insure that the heater cable is not damaged before the system is put in operation. Field tests will be conducted as soon as possible to check the predicted values.

The heating system was designed under the direction of H. H. Plumb, electrical engineer. All electrical designs are made under the general direction of H. F. McPhail, assistant chief electrical engineer, and L. N. McClellan, chief electrical engineer. All engineering designs are under the general direction of J. L. Savage, chief designing engineer, and all engineering and construction work is under the general direction of S. O. Harper, acting chief engineer, of Denver, Colo. All activities of the bureau are under the general charge of John C. Page, commissioner, of Washington, D. C.

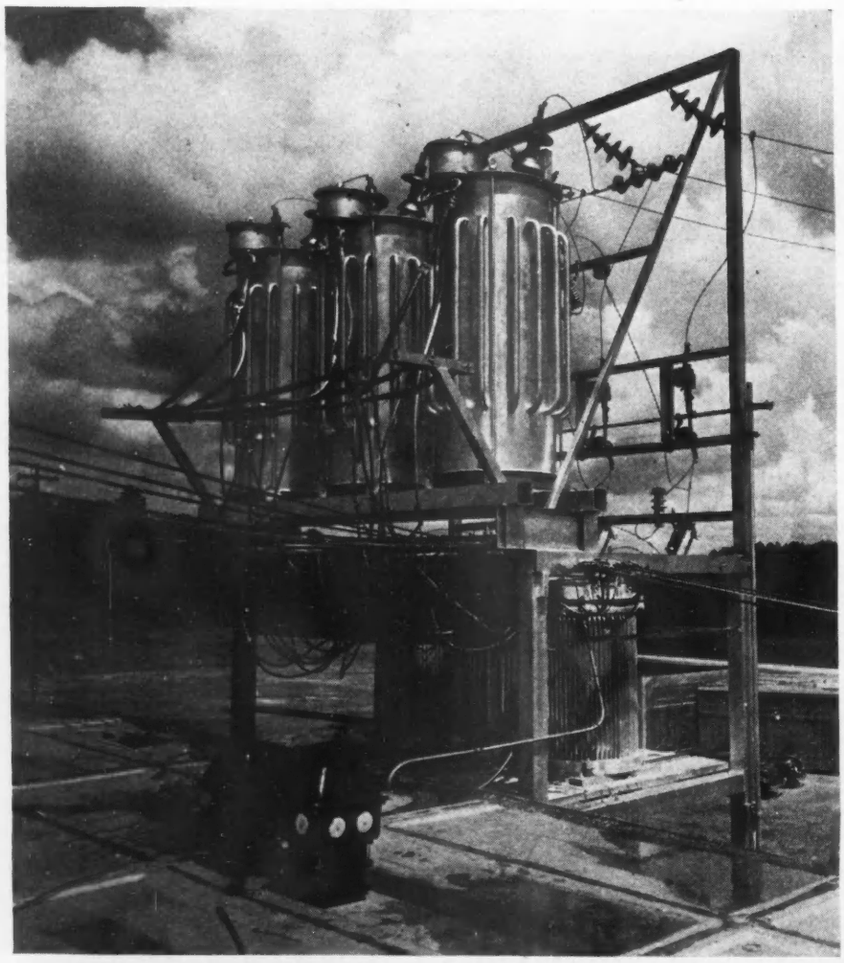

No. 1 A.W.G. stranded heating cables
14-heater cables in 7 multiple circuits
Pier plate
Gate seat
Pier plate thermostat actuating bulb
4-heater cables in 4 multiple circuits
Thermostat control tubing
Pier plate
Adjust thermostat to close mercury contacts at 125° F.
Cable designations
Gate seat thermostat actuating bulb
Thermostat control tubing
Pier plate and gate seat cable pulling and splicing recess
400 M.C.M. feeder cables
No. 12 wire
Switchboard
S.P.D.T. switch
D.P. push button
150 kva. 7,200 to 55.5 / 27.75 v. transformer
Adjust thermostats to close mercury contacts at 125° F.
D.P.S.T. switch
No. 12 wire
Switchboard
No. 6 wire
W
R
Circuit breaker trip coil
Oil circuit breaker (manually closed, temperature tripped)
6,900-volt, 3-phase, 60-cycle A.C.

**WIRING DIAGRAM for the heating installation**
Cables 1, 2 and 3 connect to same polarity. Cables 1-6 are permanently connected to transformer and controlled by 6.9-kv. breaker. Cables 7 and 8 are connected to a S.P.D.T. switch so either half or full voltage may be applied. The 48-volt, 60-cycle trip coil on each 6,900-volt breaker is energized to trip the breaker by: (a) closure of any thermostat switch on the corresponding pier plate: (b) closure of either thermostat switch on the gate seat, which trips both breakers simultaneously; (c) push button on switchboard, which trips both breakers simultaneously. In a and b, breaker cannot be reclosed until thermostat is reset manually.

# Outdoor Construction for Indoor Distribution

***Special features of product and its manufacture inspire adaptation of overhead line design to energy supply for one-story, large area factory building***

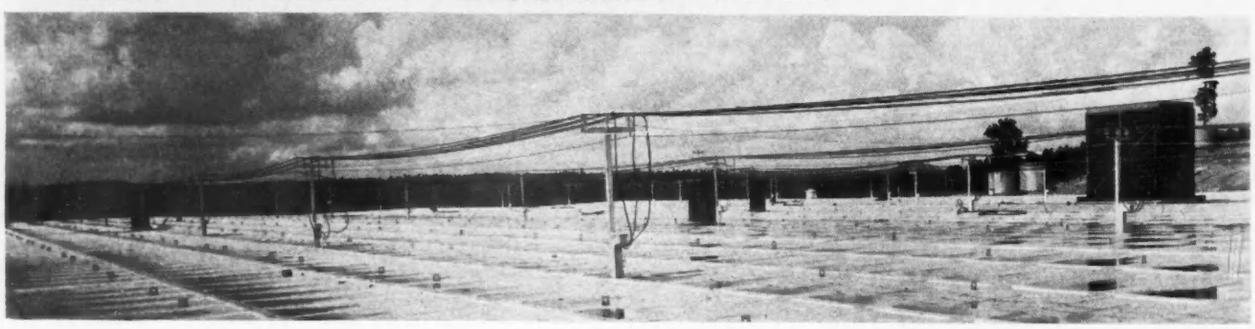
*H. L. La BAUME, Le Tourneau Company of Georgia*



ECONOMY and flexibility were the aims of a quite different system for distributing electric power in the new plant of the Le Tourneau Company of Georgia at Toccoa, Ga. Production in this factory of heavy earth-moving machines determined the design of the building itself and offered opportunity for approach to the problem of wiring from an unusual angle.

From the standpoint of production operations the plant is comprised of 64 more or less independent units, each consisting of an area of 23 ft. radius with a circle-swing crane with one or two arms in the middle. All operations in an area center around the crane. Thus it followed logically that the crane column should be the center for electrical distribution in the production area. The 64 circular areas, in so far as power supply is concerned, might be considered as 64 separate factories that, for convenience and economy, were situated under one roof. This conception was a largely determining factor in the choice of method

**DISTRIBUTION FEEDERS above roof and one of the transformer stations. Pictures taken during construction**



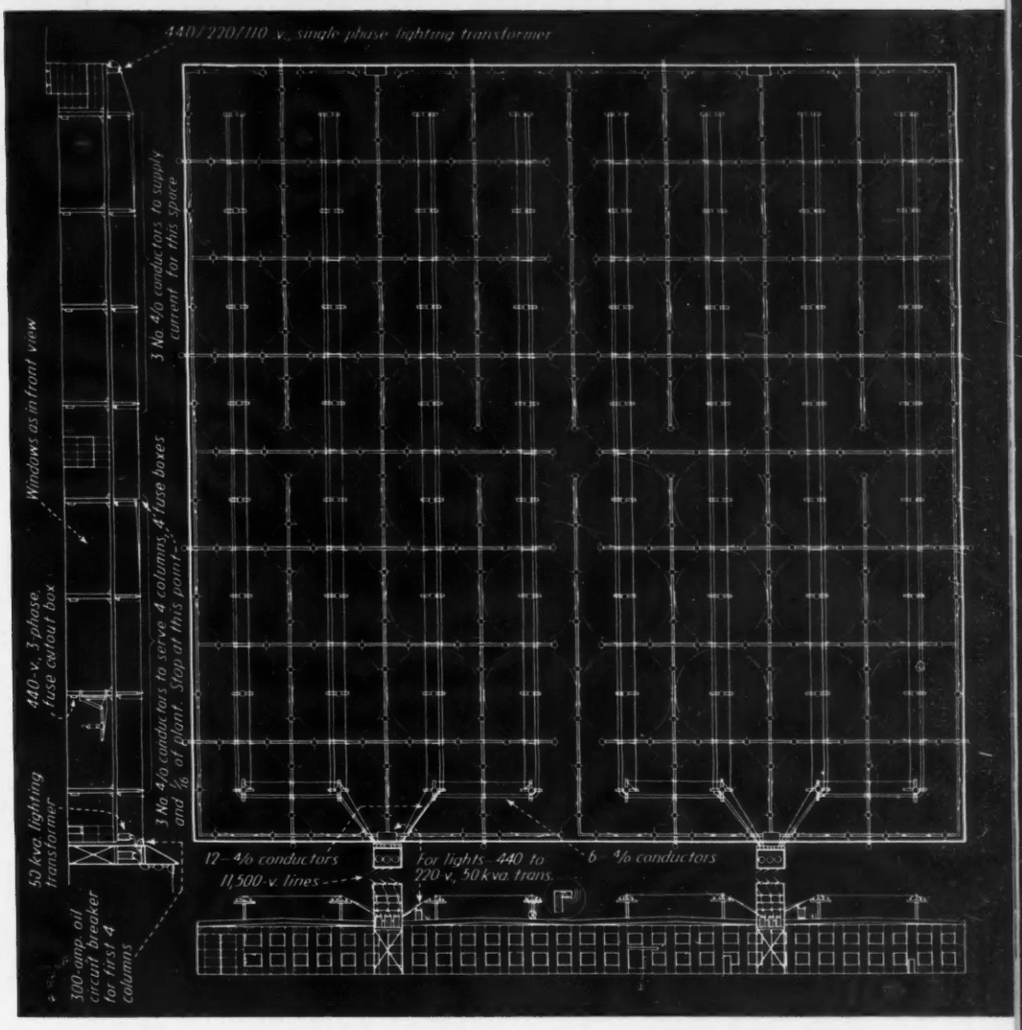
of electrical distribution. The buildings, one story about 370 ft. square, is constructed, sides and roof, of fabricated steel panels. The roof is supported by the crane columns.

Two transformer stations, 11,500 to 440 volts, 600 kva., each, supplies energy for eight 440-volt, No. 4/0 feeders which serve one-half of the plant. The transformers are supported at roof level on steel structures on which are mounted the feeder breakers—300 amp. OCB's.

Feeder construction from the transformer stations looks almost like standard overhead line practice, as appears from the accompanying illustrations. Rising about 10 ft. above the roof are extensions of each of the 64 support columns, on which are fixed crossarms that carry the feeders. At each column a tap is taken down through a weatherhead into the column and to a distribution panel of four circuits at its base. These circuits, which supply energy to the crane and to welders and other portable tools, are fused only, the disconnecting provision of the feeder breaker being considered adequate for operating conditions.

Lighting supply is taken from the power feeders. There are four 50-kva., 440/220-110-volt transformers, two at opposite sides of the roof. On the inside wall of the building, below each transformer, are two "No-fuze" breaker panels of sixteen circuits each. The circuits are carried throughout the plant in $1\frac{1}{2}$ x 3-in. steel ducts, spot-welded to the ceiling. Each circuit serves eight 500-watt Curtiss X-ray fixtures which are hung from yokes welded to the raceways. The lighting layout is shown clearly on the diagram.

This distribution scheme, while departing radically from conventional practice and presenting the rather startling appearance shown in the accompanying illustration, is working satisfactorily and seems to be well fitted for the special production conditions for which it was designed.


440/220/110 v., single phase lighting transformer
Windows as in front view
3 No. 4/0 conductors to supply current for this space
440-v. 3 phase fuse cutout box
3 No. 4/0 conductors to serve 4 columns, 4 fuse boxes and ½ of plant. Stop at this point
50 kva. lighting transformer
12—4/0 conductors 11,500-v. lines
For lights—440 to 220-v., 50 kva. trans.
6—4/0 conductors
300-amp. oil circuit breaker for first 4 columns

**PLAN of distribution**

**ALL PRODUCTION CENTERS on crane columns, which are electrical distribution centers as well**

# Integrated Program Improves Station Reliability—III

***Modernization of 13.2-kv. main bus protection involves installation of modified differential relay system, modernization of oil breakers to reduce fire hazard and increase rating and removal of grounded conducting material from switch cells***

*J. A. KEETH* and R. L. FRISBY,† Kansas City Power & Light Company, Kansas City, Mo.*

ANALYSIS of the 13.2-kv. main bus protection at Northeast station, undertaken as part of the recent improvement program discussed in two previous articles,‡ showed that considerably more than the installation of a relay system to clear and localize faults and short circuits would be required to protect effectively the bus and reduce the possibilities of prolonged outages of the station. Investigation disclosed need for modernization of oil circuit breaker to increase rating and reduce fire hazard. Also indicated was the complete removal of iron vent piping in the switch cell compartment, which had been the cause of a serious outage.

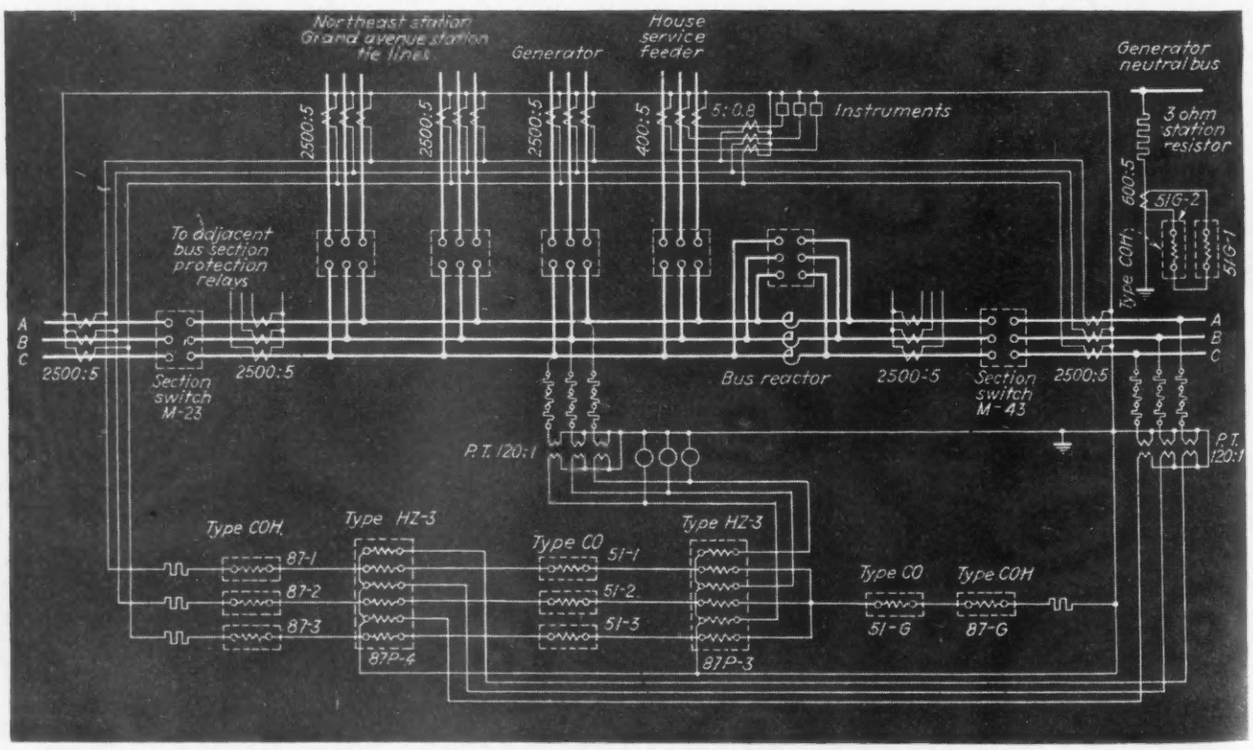
The engineering study on protection for the main buses of the station considered many problems, including:

1. Extent of protection to be provided.
2. The scheme of relay protection to be used.
3. Type and make of relays and current transformers.

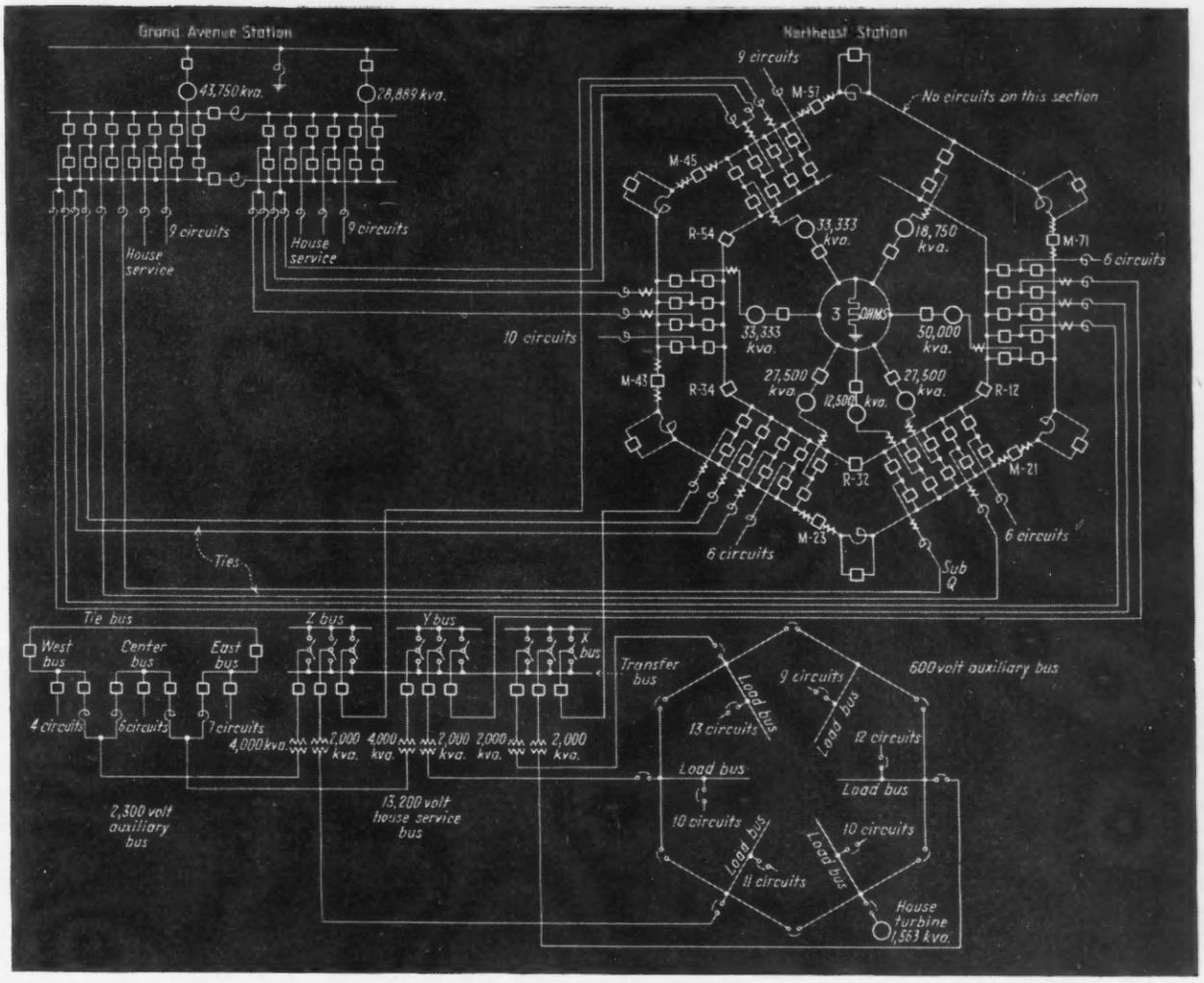
After careful analysis it was decided to protect only the main bus, which, as previously mentioned,‡ consisted of a ring of six sections connected through bus reactors and sectionalizing breakers as shown in the accompanying diagram. The second or reserve bus is used only at such times as the main bus is out of service for maintenance purposes. That is, the entire load of the station is transferred to the reserve bus twice annually, and then only for a period of eight to ten

* Manager power production. † Electrical engineer of power stations.

‡ See "Electrical World," October 19, page 60, and November 2, page 42.




**SCHEMATIC DIAGRAM of typical 13.2-kv. main bus at Northeast station showing relay protection scheme**




**RING BUS is basic element of both main and station auxiliary buses at Northeast**

hours each time. Weather and load conditions determine the days selected for such work. Occasionally one or two outgoing feeders may be thrown over to the reserve bus and one generator on the same section tied to both buses. This, however, will not disturb the protection. Owing to such limited use of the reserve bus, the cost of protection for this bus could not be justified.

### *Ratios Identical*

Straight differential protection on the main bus was out of the question for several reasons, the most important of which was lack of space to install current transformers on each of 49 feeder positions. The enormous number of transformer secondary leads and control cables would have added more of a hazard than the protective scheme would have eliminated. The cost would have been prohibitive as compared with the cost of partial differential protection, which was finally decided upon.

To avoid as far as possible incorrect operation of the relay scheme on faults external to the differential zone, several precautions were taken. New current transformers, all of the same ratio, are used on all generators, bus sections and on station-to-station ties. They are of special design, through type, with distributed secondary windings and sufficient iron to prevent saturation under most fault conditions. The secondary burdens will be held to a minimum by the use of No. 9 wire and by locating the relays for each bus section as near as possible to the protected section. All relays, tripping switches and test blocks for each bus section will be mounted in individual steel cubicles, one for each section of bus.

The only equipment installed in the main switchboard operating room in connection with the relaying set-up is a supervisory panel. The potential to the voltage restraint coils of the relays will be supervised and indications of which bus section is faulted will be obtained, as well as the sounding of a relay alarm bell.

The protection will operate on phase-to-ground and phase-to-phase faults on the bus, but will not operate on faults occurring beyond the reactors on feeders, nor on faults on generators, adjacent bus sections, nor on station-to-station tie lines. There are two exceptions to this. In case of a fault on a section tie breaker, then adjacent sections will be cleared, or on a fault on a feeder that does not clear due to failure of its relays or failure of its breaker, then the section to which it is connected will clear.

The relay set-up of bus section No. 3 is shown in the accompanying diagram; sections Nos. 1 to 5 are very similar. The relays for this section, all mounted on the panel for this section, are:

4 Type COH high-speed over-current relays.

2 Type HZ3 three-element impedance relays.
4 Type CO standard induction overload relays.
1 Type WL multi-contact auxiliary relay switch.

### *Operating Sequence*

In addition to the above there are two COH relays and two MC multi-contact relays mounted on the supervisory panel located in the operating gallery. The function of the relays under fault conditions is as follows:

1st: Fault to ground on A phase at center of bus section 3.

Relay 87P3 will close its contacts instantly, as the phase-A voltage is practically zero and a large A-phase current is flowing. Due to the unbalance caused by A-phase being grounded, relays 87G, 51G2 and auxiliary relay 51GX1 will close within a few cycles. The closing of these relays will operate auxiliary relay 87X, which will trip the generator, house-service feeder, station tie and the two bus section breakers. The operation of 87X relay also operates red and green signal lamps on the supervisory panel and gives an audible signal in the operating room. The operation of relays 87G and 51GX1 will also be indicated on the supervisory panel by colored lamps.

2nd: Phase-to-phase fault at center of No. 3 between phases A and B.

Relay 87P3 on section No. 3 will close instantly due to collapse of voltage between at least two phases. A heavy phase current will flow and operate relays 87-1 and 87-2, which in turn will operate 87X and clear the section. If for any reason these relays should fail to function, then the overload back-up relays 51-1 and 51-2 will operate a few seconds later and clear the section.

3rd: Fault on section No. 3, between bus reactor and section switch M43.

A phase-to-ground or phase-to-phase fault at this location may allow the bus voltage of section No. 3 to remain sufficiently high to prevent relay 87P3 from operating. Relay 87P4 has been added to take care of this condition. Relay 87P4 obtains its voltage from potential transformers on section No. 4 and its current from section No. 3 differential circuit. Therefore, a fault at this location will be cleared by the operation of relay 87P4.

4th: Fault on section tie breaker.

A fault at this location or on the bus between the tie breaker and the bus transformers on either side of the breaker will cause both sections to clear. This is accomplished by overlapping the current transformers of each section around the section tie breakers.

5th: Fault on feeders on line side of feeder reactor.

A fault at this location will cause a voltage drop across the feeder reactor sufficiently high to prevent relay 87P3 from operating. If, however, the feeder breaker should fail to open, the back-up relay No. 51 will clear the entire bus section if the fault continues for several seconds.

6th: Fault on generator leads.

The generators and cables are protected by an independent differential relay set-up and will be cleared independently of the bus section to which they are connected. Under this condition the bus voltage would drop to a value where the voltage restraint on relay No. 87 would be quite low; however, at the same time there would be no current in the differential circuit of No. 87 impedance relay.

### *Precautionary Measures*

Great care was taken in selecting equipment in order to obtain the most reliable scheme of protection; however, there are some inherent handicaps which must be given consideration.

The primary cause contributing to erroneous operation of bus protective systems which have been installed in the past has been the failure of current transformers to respond correctly under heavy fault conditions. Under these conditions, the current transformer core iron has a tendency to saturate, and when a current transformer saturates the turn ratio no longer holds and the secondary output does not remain proportional to the primary current.

The new current transformers that are being installed for bus protection are all designed with a large amount of iron and with distributed secondary windings so as to reduce flux leakage. Under short-circuit conditions, that calculations show will prevail, these current transformers will hold up very well under symmetrical conditions of current. It is practically impossible, however, to build a current transformer large enough with sufficient core iron to prevent ratio breakdown under asymmetrical short-circuit conditions. This is because one component of the asymmetrical current is direct current, which causes additional core saturation. To prevent faulty relay operation under heavy asymmetrical fault conditions two precautions have been taken which are as follows:

1. *Transient Shunts* — An impedance relay under transient conditions has a tendency to "reach out" beyond the point at which it is set to operate under symmetrical conditions. That is, the relay will be set to balance at a certain point within a reactor under symmetrical conditions. Under asymmetrical conditions there is a tendency of the relay to operate beyond this point. To overcome this transient shunts have been added. These shunts are connected across the current coils of the impedance relays so that during the first few cycles of a short circuit when there is a material direct-current component, the shunt will absorb most of the direct-current component and allow the relay to receive more nearly the symmetrical alternating current.

2. *Additional Time Delay*—Induction over-current relays, type COH, devices No. 87-1, 87-2, 87-3 and 87-G have been added to the impedance relays to avoid instantaneous operation. This will prevent clearing operation until most of the direct-current component has died out during asymmetrical short-circuit conditions.

### *Supervision of Potential Transformers*

It is imperative that there be potential on the restraining coils of the impedance relays at all times. Dependence is placed upon the restraint of bus potential to prevent erroneously clearing a bus section during a feeder fault. A supervisory panel located in the operating room supervises the potential transformer secondaries with red lamps. The lamps also show whether on not a bus section itself is energized. Additional supervisory lamps are provided for indicating that the bus protection is in readiness to operate, to show when a bus section relays and to show when a fictitious residual current occurs on the system. A red lamp shows that the bus protection system is ready to operate, a green lamp shows when it has operated and an amber lamp gives the signal of fictitious residual current. There is also a red lamp to show that

[*Continued on page 116*]

# The Old Story Told in a New Way

PUBLIC RELATIONS SERIES

*Consolidated Edison tells "Story Behind Your Electric and Gas Bill" with simply, concisely written customer booklet — Aim is to reduce "high bill" complaints by clearing up such misunderstandings as variations in usage*

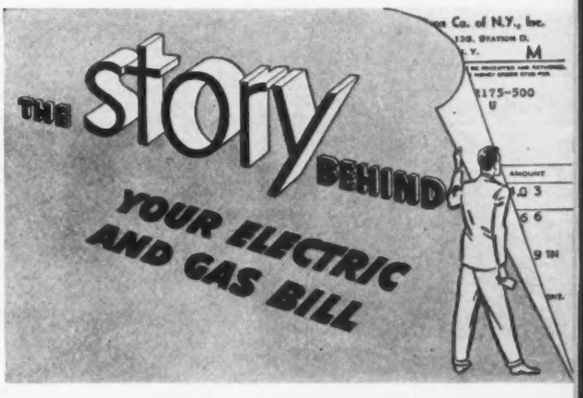
"MY BILL'S too high" is the customer complaint most frequently heard by the commercial relations department of the Consolidated Edison Company of New York, Inc. Most of the complaints, the records show, are due to the fact that the annoyed customer can't read his meter or check his bill or see why his bill should vary from month to month when he doesn't "use any more electricity than usual."

So the commercial relations department has issued a booklet, "The Story Behind Your Electric and Gas Bill," which it hopes will reduce these complaints to a minimum by clearing up the misunderstandings. Three hundred thousand have been prepared and the service clerks have been instructed to hand a copy of the booklet to every complainant.

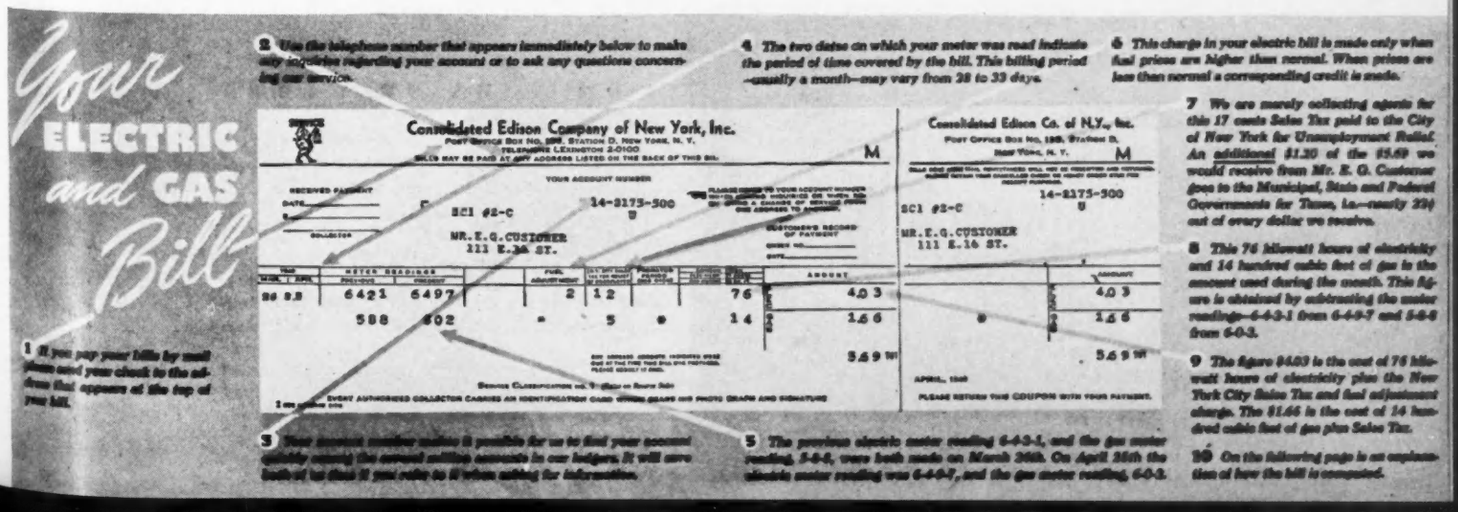
One of the most important features of this booklet is a two-page "spread" which fully describes every item on a typical customer's bill—from the telephone number to call to make inquiries to an explanation of the 3 per cent city sales tax. Other subjects covered in this booklet include: "Your electric meter," "The man who reads your meter," "How to read your electric meter," "Making sure that your bill is right," "How to figure your bill," "Why your electric and gas bills vary from month to month," "Why you are requested to pay your electric and gas bill promptly." The customer is warned against the bogus bill collector and shown a specimen of the identification card each collector of the company must carry.

Text under each heading is kept in simple language, short and to the point. Thus, in explaining why bills vary from month to month: "Not all bills follow regular pattern—some barely change from month to month, while others make substantial changes both up and down. In a way, your electric and gas bills are a picture of your household activities, the amount of time you spend at home, the amount of entertaining you do, and many other features of your domestic life. Even sickness in your family may affect your use of electricity and gas. Probably to an even greater extent your electric bill is a record of the kind of weather we have had—the number of hours of daylight and darkness, and even the amount of sunshine or stormy weather."

This section then continues with a more detailed discussion of the various factors affecting changes in bills—billing period, weather, adding new appliances, using substandard appliances and lamps.




**CUSTOMER BOOKLET tells and shows how a meter operates, how to read a meter, how to figure an electric bill, what causes variations in monthly bills. Two-page "spread" fully describes every item on a "typical" customer's bill**


Your ELECTRIC and GAS Bill
Consolidated Edison Company of New York, Inc.
MR. E. G. CUSTOMER
111 E. 16 ST.
14-2175-500
SC1 #2-C
1 If you pay your bills by mail please send your check to the address that appears at the top of your bill.
2 Use the telephone number that appears immediately below to make any inquiries regarding your account or to ask any questions concerning our service.
3 Your account number makes it possible for us to find your account quickly among the several million accounts in our ledgers. It will save both of us time if you refer to it when asking for information.
4 The two dates on which your meter was read indicate the period of time covered by the bill. This billing period—usually a month—may vary from 28 to 33 days.
5 The previous electric meter reading 6-4-3-1, and the gas meter reading, 5-8-5, were both made on March 26th. On April 25th the electric meter reading was 6-4-9-7, and the gas meter reading, 6-0-3.
6 This charge in your electric bill is made only when fuel prices are higher than normal. When prices are less than normal a corresponding credit is made.
7 We are merely collecting agents for this 17 cents Sales Tax paid to the City of New York for Unemployment Relief. An additional $1.20 of the $5.69 we would receive from Mr. E. G. Customer goes to the Municipal, State and Federal Governments for Taxes, i.e.—nearly 23¢ out of every dollar we receive.
8 This 76 kilowatt hours of electricity and 14 hundred cubic feet of gas is the amount used during the month. This figure is obtained by subtracting the meter readings—6-4-3-1 from 6-4-9-7 and 5-8-5 from 6-0-3.
9 The figure $4.03 is the cost of 76 kilowatt hours of electricity plus the New York City Sales Tax and fuel adjustment charge. The $1.66 is the cost of 14 hundred cubic feet of gas plus Sales Tax.
10 On the following page is an explanation of how the bill is computed.

# CASE HISTORIES OF 14

***Eleven users tell what circumstances justified the adoption and why the unit substation assemblies established a new philosophy in distribution design***

***F. M. STARR, Central Station Engineering Department, General Electric Company***

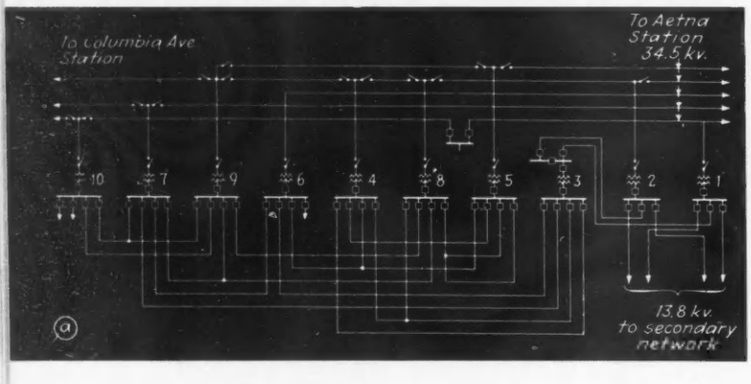
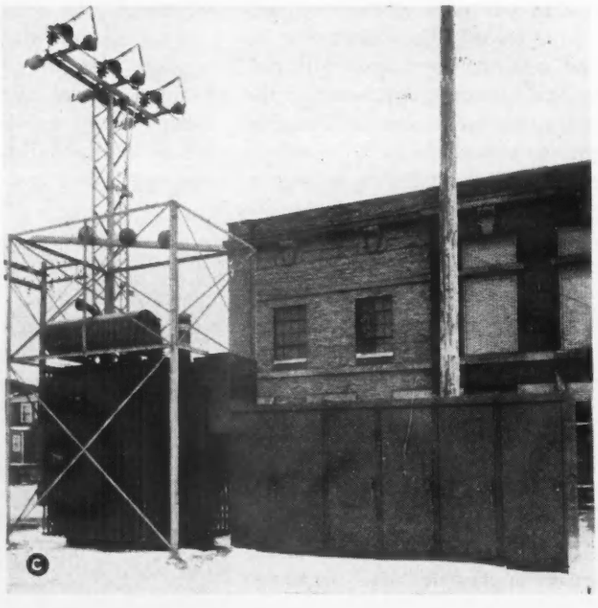
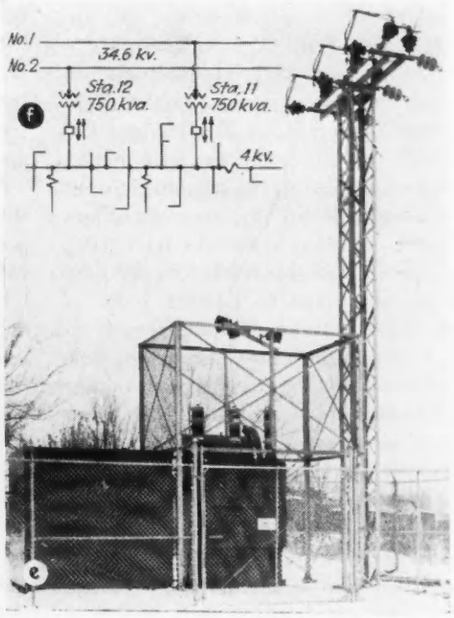
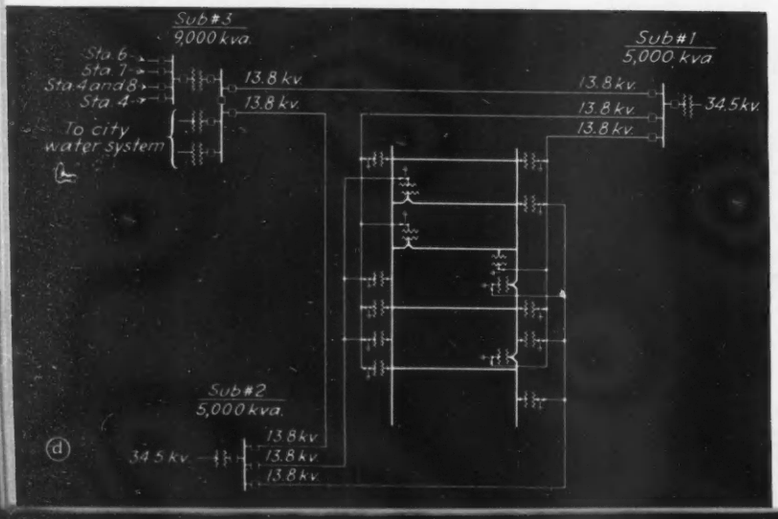



**Fig. 1—Eight 2,000-kva. units serve Gary network**—Distribution overloading and change-over to 60 cycles from 25 cycles led in 1937 to completely modernized distribution based on unit substations. It offered substantially lower cost than any comparable alternative. For example, a large radial substation would have necessitated much new distribution copper and far higher expenditure. The network has superior operating characteristics.

(a) Residential area served by primary network comprising six 2,000-kva. units and two 3,000-kva. units. Two 5,000-kva. units serve downtown secondary network. Two 750-kva. units serve the light density suburban or localized areas. This is the ultimate plan. All but one unit (No. 3) taps 34.5-kv. overhead tie-line. By means of pole-mounted




disconnects they can be connected to either of two sources. Thus expensive 34-5-kv. switching centers are averted.

(b) One of the 2,000-kva. primary network units on a small plot between buildings.

(c, d) Two 5,000-kva. units (together with existing substation) serve downtown secondary network over four 13.8-kv. feeders. Present network capacity 4,000-kva., ultimate 12,000-kva.

(e, f) Single-circuit 750-kva. unit serves localized suburban area located at original load center of 6,900-volt feeder. Single 4-kv. tie forms simplest of networks, but assures good continuity and excellent voltage. *(Gary Light, Heat & Water Co.)*

# UNIT SUBSTATIONS

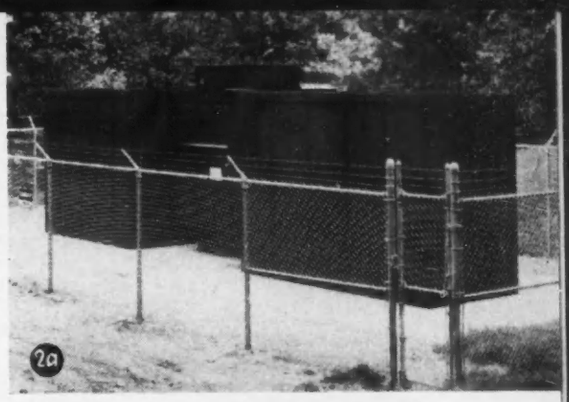
REVIEW of the economic planning which preceded installation of several hundred factory-built unit substations reveals that the following were the dominant factors in their selection:

(1) Safety. (2) Appearance. (3) Low installed cost. (4) Improved service continuity. (5) Better quality of delivered voltage. (6) High salvage value. (7) Low maintenance cost. (8) Small space requirements. (9) Short time for installation.

Practically all units have three-phase transformers which are regulated by means of automatic load-ratio-control equipment. The range in capacity is from 450 to 8,000 kva., but the majority are 1,500- or 2,000-kv. units.

About half the units have been adapted to some form of primary network and the rest are used in one of several forms of radial distribution.

The accompanying case histories have been selected as representative of the field.



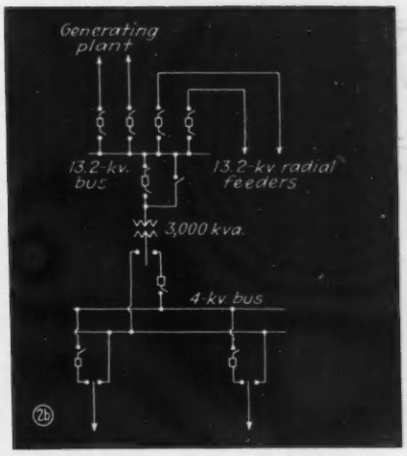



**Fig. 2—Two similar units serve Tulsa radial distribution.**—Preferred residential area developed rapidly and required new substation. A new 13.8-kv. switching center also needed. Unit substation combined both functions on small ground area. Serves two 4-kv. feeders with provision for additional circuits. Good appearance, limited space and safety were dominant factors in choice of unit substation. *(Public Service Company of Oklahoma.)*

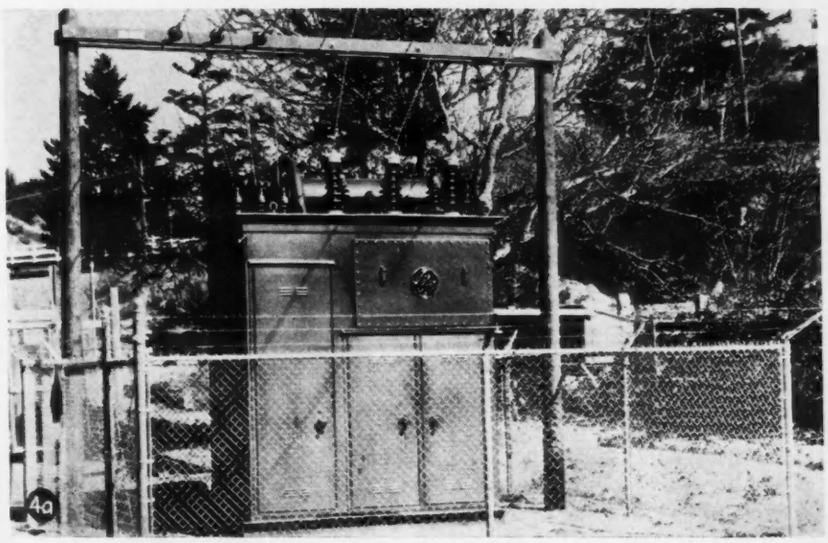


**Fig. 4—Two towns on rural line served by single-circuit 1,000-kva. unit.**—Installed primarily to relieve overloaded substation. Cost saving was determining factor ($12 per kva. vs. a cost from $1 to $5 per kva. more for conventional equivalent). Installation took only two days after preliminary preparations. Construction crew released quickly for other urgent work. Will be used to absorb load growth elsewhere and be replaced by larger unit when the load increase warrants. *(Coast Counties Gas & Electric Co., Santa Cruz, Cal.)*

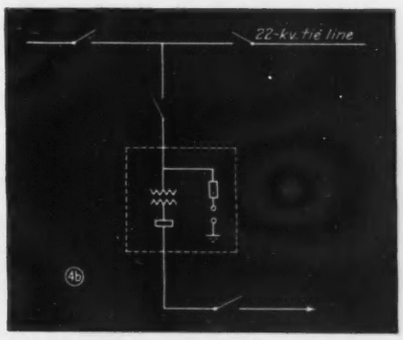
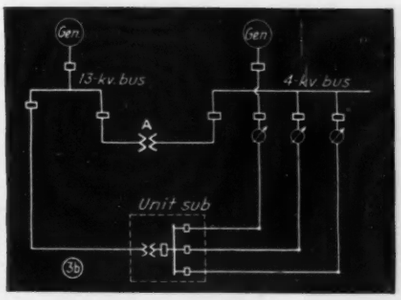
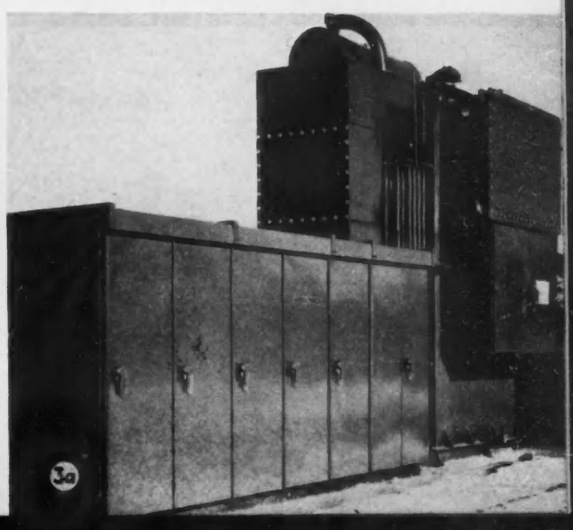
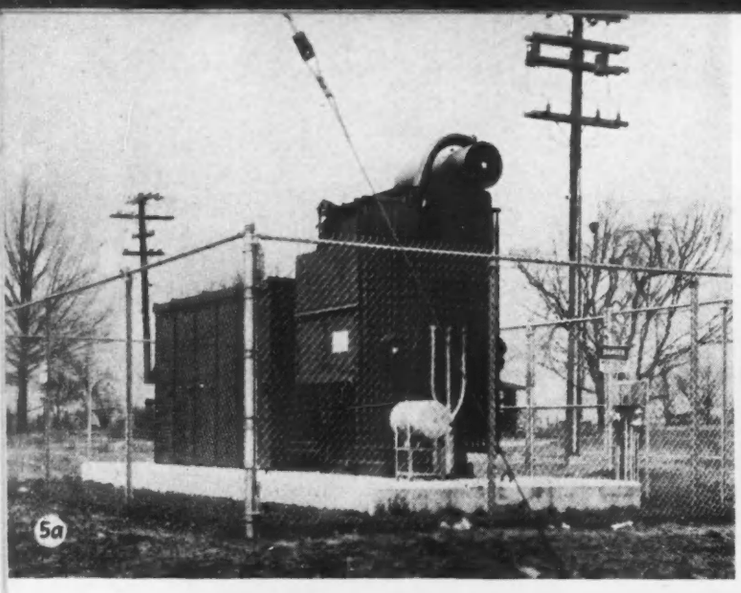
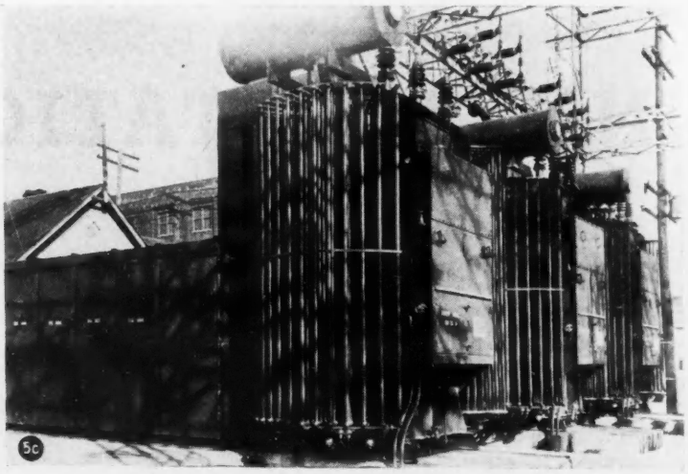


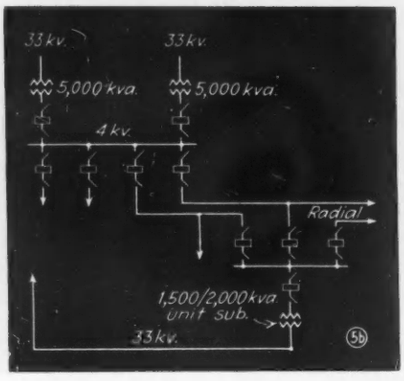

**Fig. 3—3,000-kva. unit relieves 4,000-volt primaries and station-bus transformer banks.**—Until 1939 all primary distribution was from 4-kv. bus in generating station. Feeders and banks between 4- and 13-kv. buses were becoming overloaded. Congestion in building precluded installation of additional feeders at station bus. Unit substation tied in with three existing feeders to form small primary network. Installed cost approximately same as new 4-kv. feeders. Advantage is the evolution of program to relieve generating station of distribution function. Substantial reduction in primary copper losses and improvement in delivered voltage. *(Lynn Gas & Electric Co.)*









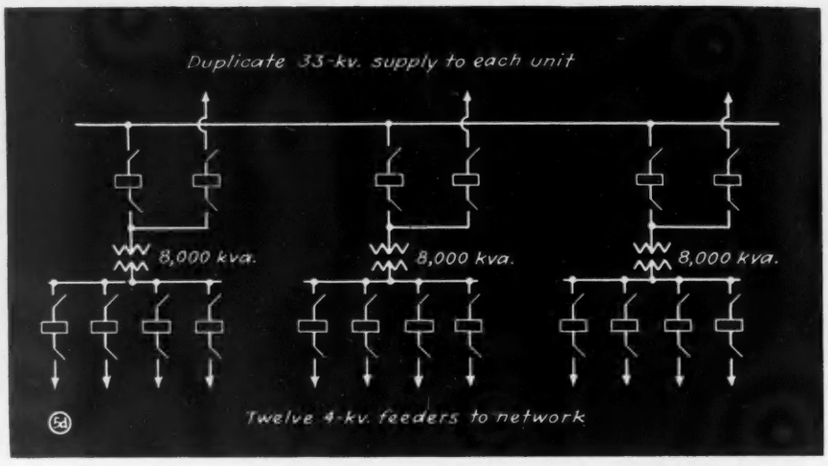




**Fig. 5—Units are nuclei of several small primary networks.**—(ab) Several 1,500, 2,000 and 3,000-kva. units tied in with large substations provide substation and feeder relief. Eventually the resulting embryonic networks will be expanded into four isolated networks supplied from the four major 33-kv. subtransmission centers. (cd) Unit substations improve supply to downtown secondary network in Indianapolis. Supply previously was a 4-kv. feeder from generating station. Three outdoor 8,000-kva. unit substations relieved congestion in station and gave a more reliable source. Each serves four feeders and is equipped with automatic tap-changers. *(Indianapolis Power & Light Co.)*

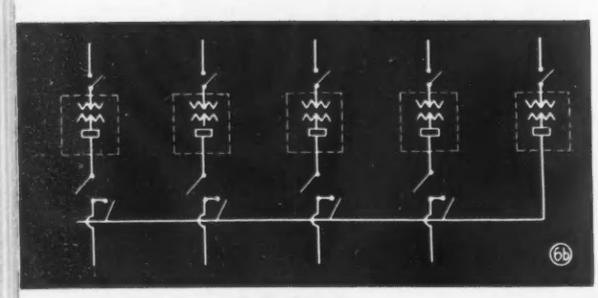


**Fig. 6—Substation units composed of single-circuit assemblies.**—Two of five installed to serve four radial feeders (one spare). Company has standardized on 1,500-kva. units, using one or more depending on load. Spare available to serve jointly areas supplied by single units. Conclusions of analysis—"over-all costs greatly reduced, maintenance costs reduced, greater safety in operation and maintenance and increased reliability of service." *(A Southeastern Utility.)*

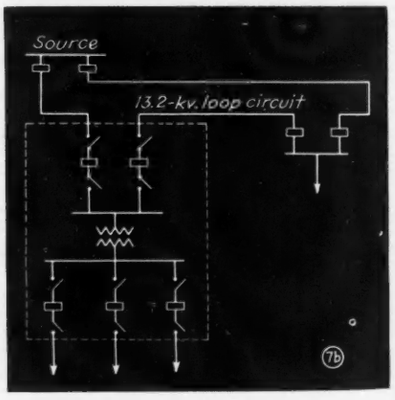
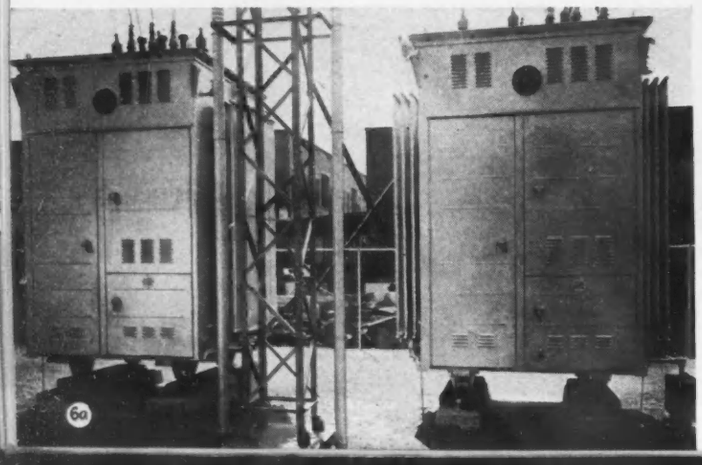
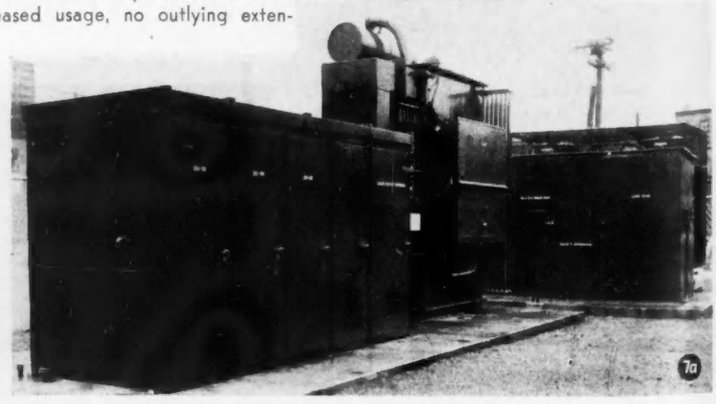
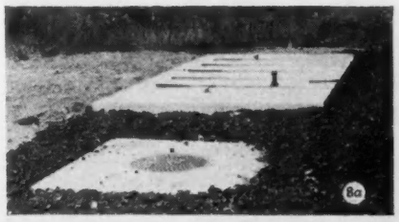
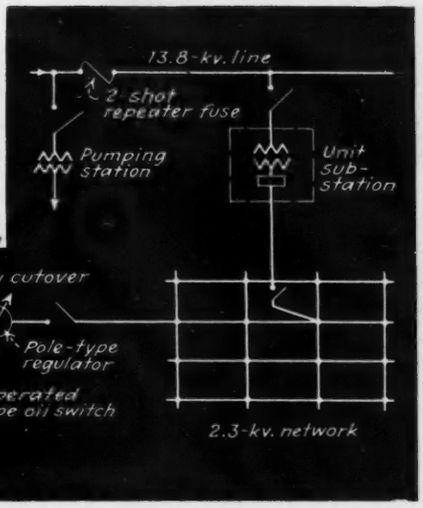


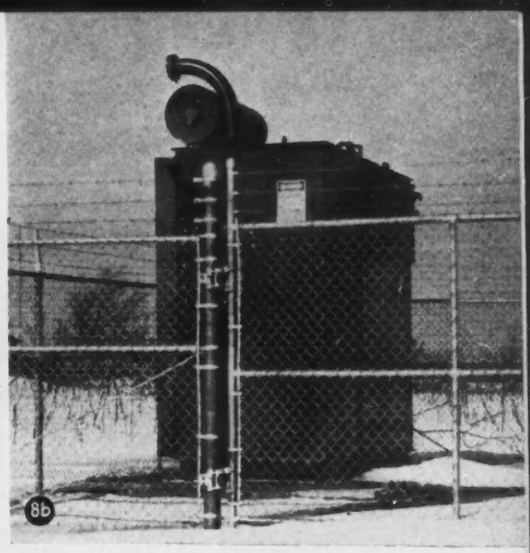

**Fig. 7—Heavy load growths in congested areas absorbed by unit substations.**—Service area confined to city limits. Growth alone increased usage, no outlying exten-

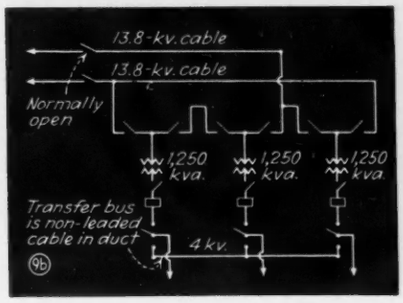


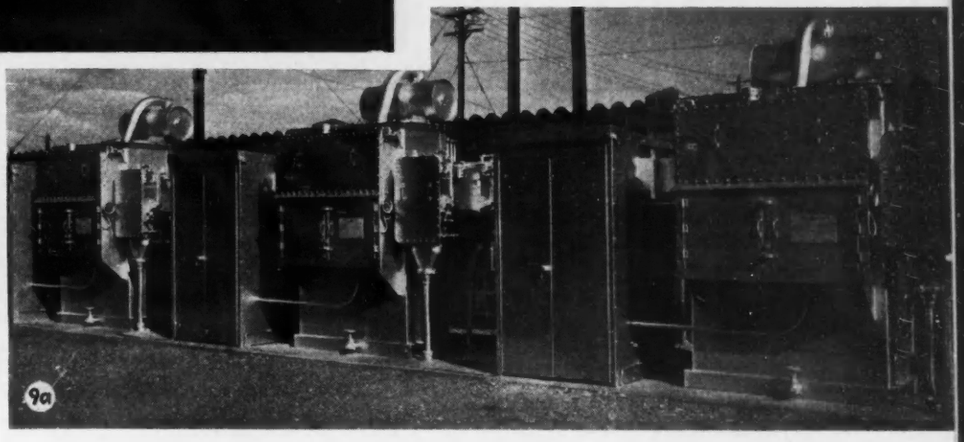








sions, load of uniform characteristics and unusually high density. Solution fixed on units as large as 3,000 kva. for best performance and economy. Location of 13.2-kv. loop lines afforded duplicate service to radial units. Several of the units have both primary and secondary switch houses. All incoming and outgoing circuits are underground. An important advantage was the short time required for purchase and installation, another was the elimination of much preliminary engineering and planning. *(Cambridge Electric Light Co.)*

**Fig. 8—Unit meets both increased load and voltage fluctuation.**—Single-circuit 600-kva. unit placed in November, 1939, corrects voltage dips over 8-square mile area previously served by 23-kv., three-phase induction voltage regulator at generating station 4 miles from load center in conjunction with smaller pole type regulator one mile from load center. Voltage had been satisfactory until advent of new brass and copper tube mill load. Added factors were reliability of service, automatic voltage regulation, good emergency connection, employee safety and safety and sightliness in a residential area. All difficulties of the replaced system entirely overcome.

(a) Manhole for cable junctions and concrete pad for the unit substation. (b) Unit at load center fed underground from 13.8-kv. on lateral pole to eliminate exposed conductors and energized parts. (c) To insure against prolonged service interruption in event of failure of single 13.8-kv. supply the unit substation can be fed from adjoining 2.3-kv. network by closing hand-operated, pole-type oil switch. The same pole-type regulation mentioned above is inserted by closing this connection. This emergency cut-over suffices for temporary operation. *(Erie County Electric Co.)*

**Fig. 10—Spot network comprised of radial substation with two 13.2-kv. sources of supply and two 1,500-kva. transformers.**—(a) Location on pier is subject to unusual moisture so installation was of subway submersible design. Cold storage and ice-making load of 750 kva. (2,000 kva. ultimate), 2.3 kv., three-phase initiated the installation. To have supplied it from nearest 2.3-kv. substation source (8,000 ft. away) would have required one (initial) or two (ultimate) new regulated underground commercial circuits. Further, the 2.3-kv. switching equipment there was of obsolete design and consequently economic consideration had been given to its replacement on the initiation of a primary network to serve the area. (b) By installing a two-transformer unit at the load, fed by taps from 13.8-kv. lines, it was possible to provide proper supply with good regulation for the new load. Ultimately one of the transformers can be used as part of another network at a different location with 2.3-kv. ties between units. *(An Eastern Utility.)*

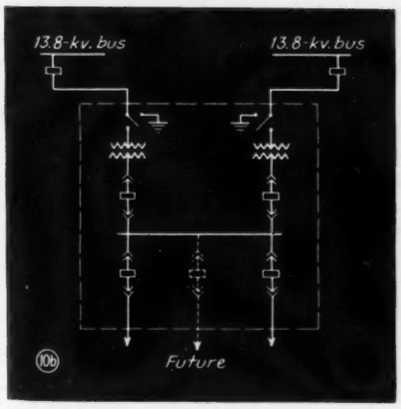
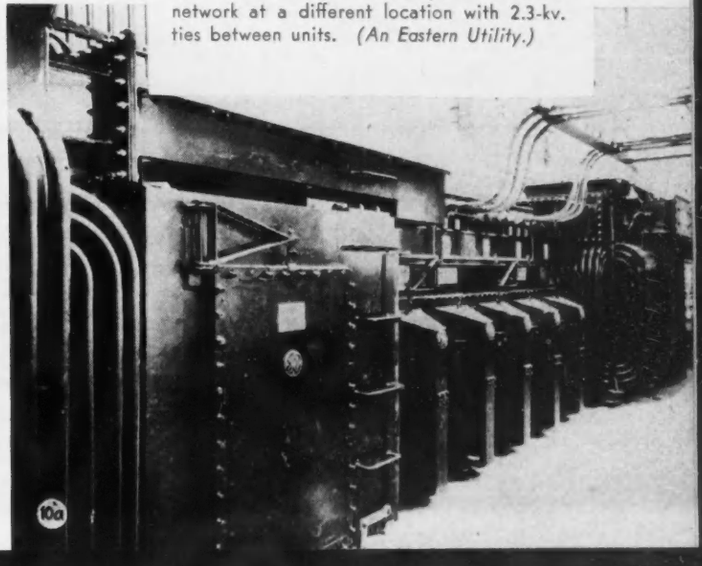
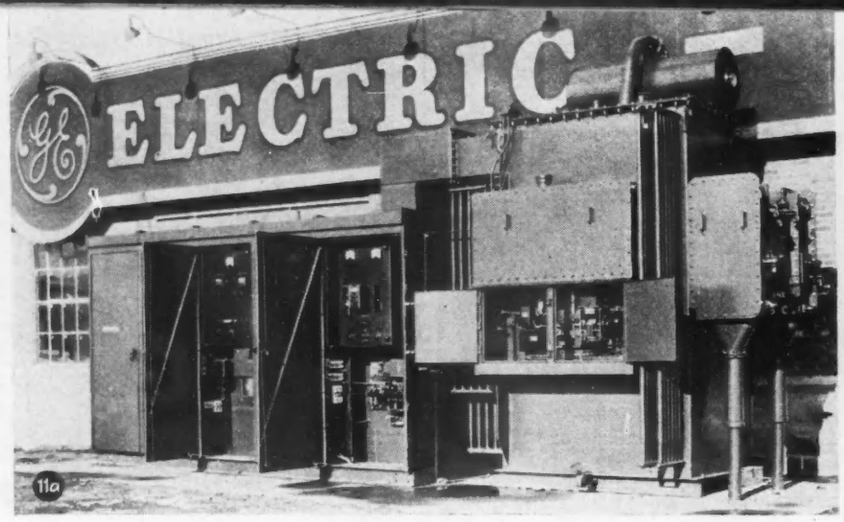



**Fig. 9 — Three 1,250-kva. units installed at Sunset substation over four-year period.** — Appearance, safety, low installed cost, minimum space requirements and ability to expand capacity in small increments were deciding factors. (a) The third absorbed rapidly growing load in fine residential area. (b) Each serves one 4-kv. radial feeder and may be switched to either of two 13.8-kv. supply circuits. *(El Paso Electric Co.)*





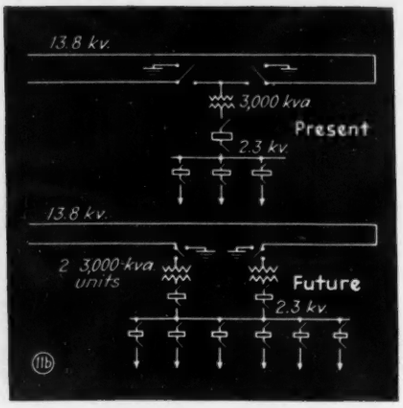




**Fig. 11—3,000-kva. unit serves plastics plant requiring high degree of service continuity.**—(a) Unit is completely metal inclosed and affords safety without fence or inclosure. Other influencing factors were appearance, proximity to load, continuity of service and flexible expansion for load growth.

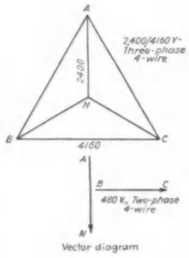
(b) Duplicate primary service from two 13.8-kv. overhead lines. Two three-position, oil-immersed disconnects mounted on transformer sectionalizing. Because load may double, the unit has been designed for addition of a second transformer and three more 2.3-kv. feeder positions as shown. *(General Electric Co.)*

# Economical 3-Phase to 2-Phase Conversion

***Auburn distribution system changed without motor replacement — Feeder loading was corrected by balancing other transformer banks***

***JOHN L. COLLINS,* Central Maine Power Co., Augusta***

IN CONNECTION with the installation of a new substation for the city of Auburn the Central Maine Power Company developed an economical and convenient method of changing over its then obsolete two-phase distribution system to three-phase, four-wire, 2,400/4,160 Y with no serious interruptions to service while the cut-over was in progress. Due to the fact that the large power load in this city consists mainly of shoe factories and associated types of industries with very large numbers of small motors, it was too costly in money and lost production time to effect the change by the simple method of replacing customer's motors.



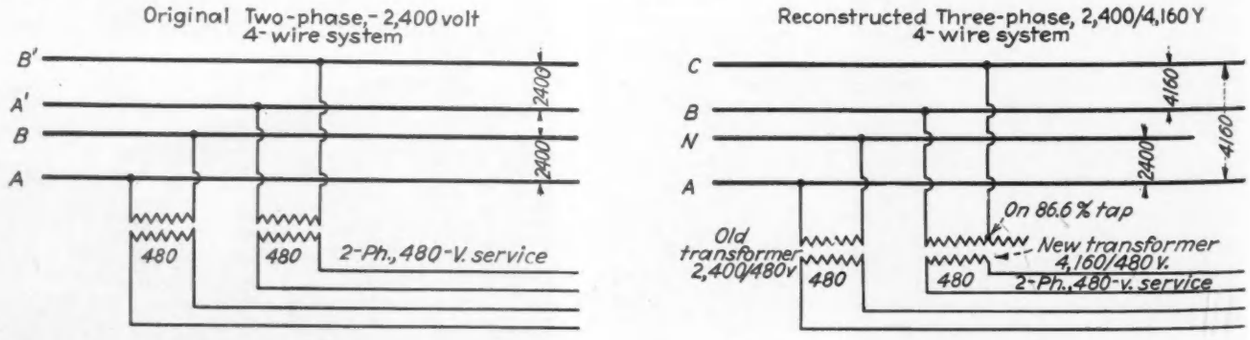
Vector diagram

The old two-phase system was perfectly adapted to the change proposed as each circuit was already a four-wire one and could be changed without adding any new conductors. Thus to bring the new three-phase, four-wire type of system to the service transformer banks presented no problems at all. To change these transformer banks, however, from the two-phase/two-phase type, to three-phase/two-phase banks, have no serious interruptions, use nothing but standard equipment and do the job economically resulted in adopting the scheme herein described, which manufacturer's engineers have said was the first known case of its use in this part of the country.

The old two-phase banks had two identical 2,400/480-volt transformers generally installed on steel platforms. The first step was to purchase for each bank one new transformer of the same size but rated 2,400/4,800 to 480 volts and having a tap on the 4,800-volt winding at the 4,160 point, or at 86.6 per cent. At a convenient time one of the old transformers of a bank was removed and the new one set in,

[*Continued on page 125*]

*Plant engineer.




**ORIGINAL AND RECONSTRUCTED four-wire feeder and transformer connections**

# Load Conditions on REA Lines

***Survey of 140 REA systems reveals 15-minute demand of 0.262 kw. for the average consumer, who uses 53.8 kw.-hr. a month — Typical load factor practically constant for systems of over 600 consumers at about 30 per cent***

***DONNAN E. BASLER,* Rural Electrification Administration, Washington, D. C.***

SEEKING fuller information on load characteristics of rural consumers, the Rural Electrification Administration made a study of load conditions on 140 REA projects during the peak months of September-December, 1939. From this survey it appears that the average REA consumer has a fifteen-minute demand of 0.262 kw., with a monthly consumption of 53.8 kw.-hr. For systems with more than 300 consumers the demand changes very little, approaching 0.25 kw. per consumer. System load factor remains fairly constant at about 30 per cent for those systems with more than 600 consumers.

### *Selected Data*

Data for the load study were taken from monthly operating reports for the period covered and were accepted or rejected in accordance with the following requirements:

1. That no large growth in number of consumers occurred in the two months preceding and the four months included in the study.
2. That the demand and consumption showed no unusual fluctuation.
3. That the commercial load on the system was not more than approximately 10 per cent of the total load.
4. That no irrigation loads were served by the system.
5. That the system was served by only one substation, since demand records from two or more substations cannot be correlated without recording demand meter charts.
6. That cases in which demand or consumption appeared out of line would be studied individually to determine any local conditions of a peculiar nature which would cause the discrepancy.

To make the data from the systems comparable, it was necessary to transfer them to a per-customer basis. The figures were then averaged for the four month period covered by the study, to eliminate the effect of uneven metering practices found on the REA projects. After this operation it was found that the spread of the points when plotted was too great for curve drawing, therefore the data were condensed by the use of a five-item, followed by a three-item, moving average before the curves were plotted. The deviation of the original data from the final curves is approximately $\pm 10$ per cent, a fact which may be of value to those using the material.

In all of the curves the demand plotted is the coincident fifteen-minute demand found by dividing the maximum system demand metered at the substation by the number of consumers. (At the present time no data are available which will give the maximum demand for a single consumer.) Consumption is the number of kilowatt-hours per month measured at the consumers' meters.

*Curve A, Demand vs. Consumption*—This is a curve of system load history with average consumption indicated at 53.8 kw.-hr. per month. Up to 40 kw.-hr. per month the increase of demand with respect to consumption is greater than average, indicating the use of a majority of peak loads such as lighting. From 44 to 51 kw.-hr. per month demand increases but little, indicating that the appliances purchased during this period in the consumer's load history are off-peak loads, particularly refrigerators. Following this, the rate of growth resumes the average trend until it reaches 65 kw.-hr. per month, when the demand increases rapidly as the result of such peak loads as ranges and hot plates. After that, the curve gradually slopes off, showing a saturation of peak-load

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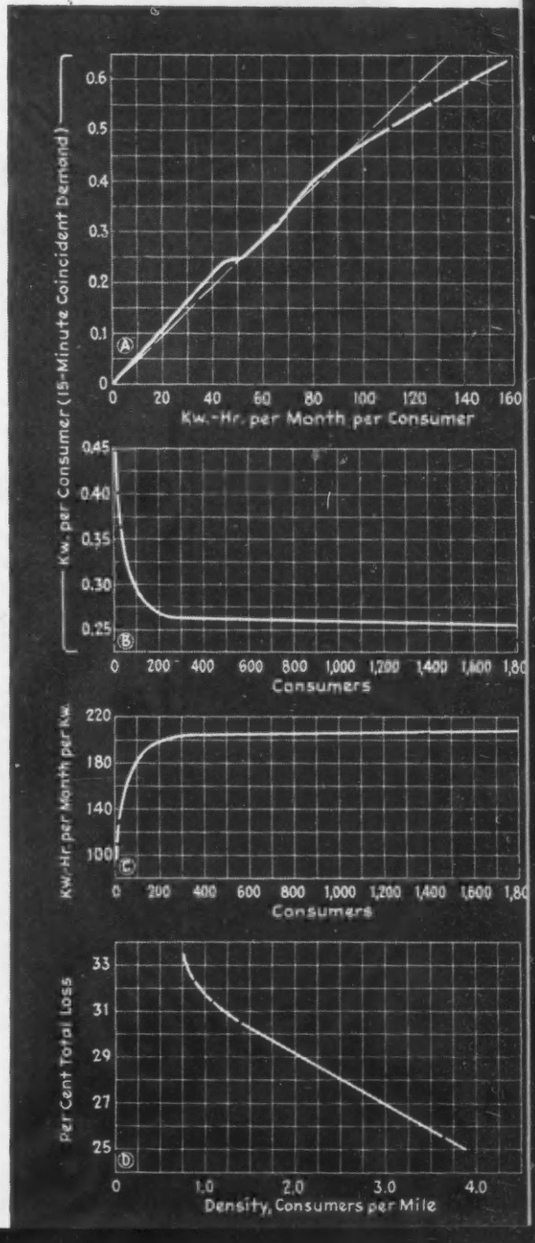
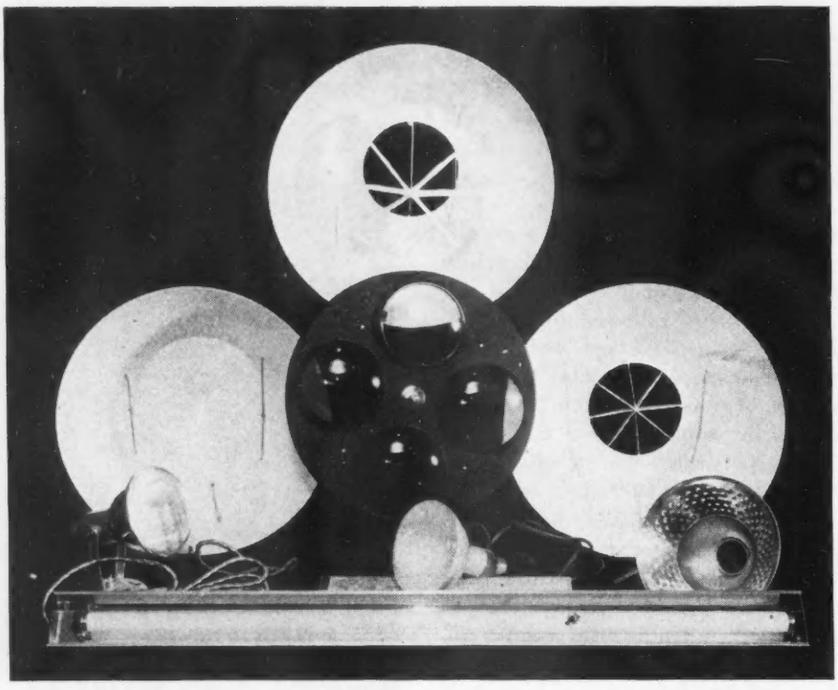



* Assistant research engineer.

# Commercial Lighting Yields $13,200 per Year per Man

*Detroit Edison adds 1,900 kw. and 2,900,000 kw.-hr. of new usage through ten thousand door-to-door calls distributed among 26,000 low-use commercial customers*

*L. E. TAYLOR,* Detroit Edison Company, Detroit, Mich.*



**PRICED to fit the purse of the small storekeeper, selected for specific and typical lighting needs, the salesman's kit includes fluorescent, incandescent, projectors, spotlights, window reflectors, reflector lamps and adapter units**

DESPITE their small margin of profit and limited budget for improvements, the small stores that dot metropolitan areas today offer a vast and challenging market for increased revenue through lighting. Undeveloped, the return from this field represents little or no profit to the utility companies. But the small storekeeper is interested in the use of light for selling. He needs only to be shown how to use it with benefit to himself. The challenge in this situation for the utility is how to sell modern lighting equipment to the small merchant at a price he can afford and at a sales cost that the utility can justify out of increased revenue.

Upward of 26,000, or 45 per cent, of the 56,850 commercial meters served by the Detroit Edison Company in metropolitan Detroit are in this small-store group and consume less than 250 kw.-hr. per month. This market has been given special attention by the company's lighting sales division during the past 20 months in an effort to determine whether a sufficient increase in consumption could be obtained at a cost that would justify the activity.

Our approach to the problem of selling this class of customer has been through the promotion of low-cost adapter-type lighting equipment, using the time-tried rule of demonstration. Fortunately, equipment and lamp manufacturers have provided the industry with a fine variety of low-cost equipment of this type. Armed with a kit of samples of adapter units and assigned to districts of about 8,000 meters each, salesmen make door-to-door calls demonstrating the sales advantages of good lighting with actual equipment, and, what is more important, equipment priced within a range that can be afforded and that is easily installed.

The kits carried by the salesmen include:

1 Utilite holder No. 1.
1 R-40, 150-watt reflector lamp.
1 P.A.R., 150-watt projector lamp.
1 Mitchel roto-color spotlight.
1 Mitchel fluorescent showcase unit.
3 Swivel sockets
1 Wakefield No. 2456.
1 Wakefield No. 2456-L.
1 Wakefield No. 2456-D.
6 Wakefield C.O.R.—150—window reflectors.

The value of having such an assortment readily available for demonstration cannot be overestimated. It is easy to approach a customer with some piece of equipment to show him that he can use to advantage and it also provides an excellent lead into the lighting story. With this assortment, also, most any application of light conditioning in the average small store can be shown.

Lighting equipment is not sold direct to the storekeeper by the

*In charge of lighting sales.

"EYE IT, TRY IT, BUY IT," the Chevrolet slogan, works for the Detroit Edison salesman. Note size of lamp going into new fixture

demonstrator. This is in accordance with the company's non-merchandising policy. When prospects are interested in buying specific equipment a "demonstration order" is executed, calling upon dealers to deliver equipment to the customer which, if satisfactory, will be purchased. Sale of equipment is consummated between the dealer's agent and the storekeeper when the latter signs a sales order presented with the goods on delivery. This method has been explained in a previous article in ELECTRICAL WORLD (January 13, 1940, page 136).

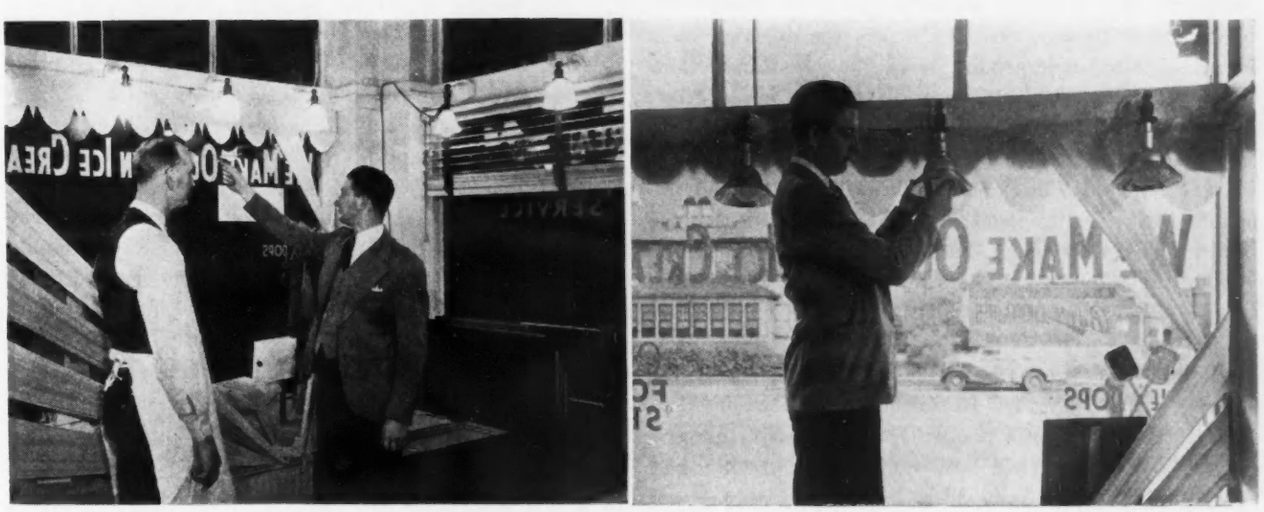
The sale of adapter lighting equipment in the small store field using this approach has produced the following results for the twelve months ended December, 1939; these results include those customers who installed permanent equipment; however, the adapter approach was used in each case:

| | |
|---|---|
| Number of men making calls | 8 |
| Number of calls made | 10,369 |
| Kilowatts added | 1,898.9 |
| Estimated annual kw.-hr. | *2,906,594 |
| Estimated annual revenue | *$105,617.74 |
| Dollar volume of equipment sold through "demo" orders | $2,194.84 |

*These figures are based on the average hours use and average cost per kw.-hr. for each customer adding load taken from a current bill.

Cost of the additional revenue for the above period ran about 25 per cent of the total sales for the year and included salaries, transportation and equipment. It is to be particularly noted that the above figures include a period of two months during which a strike in one of Detroit's largest automobile factories was reflected in a reduction in the gross sales by the small merchant.

Our conclusion, based on experience, has been that modern lighting equipment can be sold to the small merchant, with, of course, the attendant increase in the use of electric service, if a plan is developed whereby it is made easy for the customer to buy.



WINDOW LIGHTING also undergoes a facial treatment as an assortment of bare bulbs and old-fashioned glassware gives way to modern adapter installations

# Editorials

S. B. WILLIAMS, *Editor*

## *A Study of Bombing Effects Indicated*

WHAT has been the effect in London and in British industrial areas of bombing on electrical generating plants and distribution lines? The newspapers in reporting the claims of both sides repeatedly state that large power stations were the targets and that hits were made. How severe has been the damage and what measures, if any, have been effective in minimizing outages?

The army recently drew up a series of suggestions for electric service to munitions plants. They are only recommendations at present, but they might easily be made mandatory at any moment. None of these recommendations, however, it was learned, were based on knowledge of what is happening in England or on the continent. They merely represent, in the absence of definite knowledge, what to the army engineers seem like the most logical things to do. Are they the best and most practical?

For instance, these suggestions call for underground service, on the theory that the greater damage comes from bomb splinters and fragments of debris that are hurled about by an explosion. But what of a direct hit on a street carrying underground cable? Such small information that trickles through from the British electrical press (ELECTRICAL WORLD, October 26) tells nothing about underground service, but does indicate that the damage to overhead is not so great but that it can be repaired quickly. Are we making a mistake, then, in insisting on underground service to munitions plants when we know that restoration of service after a direct hit would take longer?

Likewise, in the matter of concentration of power in very large stations, are we basing our judgment on lessons learned in England? The indications are that the British are rather glad that the Grid, with its small number of large stations, had not progressed further, for they now have the power supply flexibility of the many small plants.

All this leads up to the suggestion that the action of the New York City Fire Department might recommend itself to American power people. These New York firemen are in London studying fires caused by bombing and how the London fire-fighters are handling them. A small group of American power engineers, including representatives of the army as well as the utilities, might, by visiting England at this time, learn enough of the practical side of maintenance of power supply under modern war conditions either to assure us that we are on the right track or to indicate the measures that from England's experience seem to be the proper ones to take.

## *Reasonable Factors of Safety*

IN A SHOWING last week of a new line of motors that greatly increased the horsepower for a given frame size the trend from the beginning to the use of less and less poundage of material was depicted. This trend toward economy of material brought to mind the desirability of applying reasonableness to factors of safety in other items of electrical construction. There seems to be a fetish for applying to electrical service maximum safety factors rather than reasonable minimums.

One good example is the National Safety Code. In the beginning it required extreme factors of safety for power line construction. Because of a lack of sufficient factual data on strength and loading, this was undoubtedly the right course to take at that time, but since then any modification involving lower factors of safety have been grudgingly conceded. This year the Code is again being revised, and in spite of a large amount of painstakingly gathered factual field data, with inferences concurred in by the power, communications and railway groups, compromises have had to be accepted.

Another example is the National Electrical Code, where the maintenance of existing safety factors is strenuously defended. Every time some new material or method gains Code recognition dire results from fire and shock are predicted. The fact that they do not occur tends in no way to reduce the defense of high standards. In the case of bare neutral, for instance, the factual report of an unbiased agency on the long-time field experience of many cities failed to convince the N.F.P.A. electrical committee that lower safety factors would still provide reasonable safety.

In the case of utility companies the factor of safety as applied to service has resulted in a continuity of service that is not appreciated by the customer nor required. One speaker at the recent E.E.I. convention asked if perhaps we were not gold-plating utility service, especially since some customers did not experience a major outage in more than a generation. Nevertheless, the utilities are constantly striving further to perfect their service. Lower factors of service safety will still provide reasonable dependability while costing considerably less. Recent experiences in rural lines afford an excellent example of this.

Somebody once suggested that factors of safety were really factors of ignorance! When people do not know what constitutes reasonable safety they insist on high values. This costs money, without, as a rule, any offsetting advantages. A healthy doubt of the wisdom of some of our electrical factors of safety in service, wiring, materials and construction would appear to be in order.

## Power Supply for Army Training Camps

A NEAT PROBLEM in power supply is being afforded by the army training camps that are springing up throughout the country. In almost every case these camps are being located at somewhat remote places that involve considerable expenditures for lines. The army does not want to build the lines because it would involve the securing of rights-of-way. Also, the army is not permitted to contract for more than one year. These camps are estimated to require about 100 watts per man so that the loads can be sizable.

Since these are not permanent loads, nor can the terms of them be predicted, the question of cost amortization arises. Can the line be entirely separated from all other service so that its cost might be amortized under the five-year munitions investment program? So far, we learn, the companies have elected to absorb the cost in their investment account simply by pushing forward some permanent investment.

When the companies do not care to absorb this extra investment and find it difficult to qualify under the defense amortization plan, the suggestion has been made, quite unofficially, however, that a service charge equal to the cost of the line be charged the first year. Each year thereafter, since the army can contract for only one year at a time, the company would rebate the army one-fifth of this charge. The more practical suggestion would seem to be for REA to build and operate the line, with the utility furnishing the energy. In this case the government would be taking its own investment risk, while the utility would be freed from any expensive accounting problem or any charge of gouging the army. REA has the money and is ready, and in fact has already contracted to serve Camp Shelby with energy from the Mississippi Power Company.

## Rate Reduction by Dividend in Practice

IN OUR ISSUE of October 19 we commented on a suggestion for rate reduction by the dividend method, pointing out what seemed to be obvious advantages and disadvantages. Since that time we have received two letters from utilities, one the municipal plant at Jamestown, N. Y., and the other from the Hartford Electric Light Company, both of which operate on the dividend basis. These two letters will be found in this issue on page 120.

These two utilities are highly regarded for the soundness of their respective managements, so that their experience in this form of rate reduction, which covers several years, should carry considerable weight. Both testify to the efficacy of the dividend plan without seeing in it any of the problems which were raised.

The strongest point presented, in addition to the fact that the plan appears to work, is that the method gives a utility what virtually amounts to a rate increase during a period of depression or of rapidly rising costs through omission or reduction of dividends, thereby giving a stabilizing effect to earnings. If we are approaching a period of inflation in prices and taxes, which with the prospective large increase in national debt seems probable, such a rate program would appear to have added merit.

One further element in the Hartford program which recommended itself to us is the sharing of the dividend with the stockholders and employees as well as with the customers. The point was made in our previous editorial that no company should put the dividend plan in force unless it was willing to strive to the utmost to produce consumer dividends. When the plan is not one-sided, but includes an incentive for the owners and the workers as well, the objections that the consumer might not get a break fall by the wayside.

## New Product Development for Peace-Time Markets

A BUSINESS PRACTICE of long standing is to pay less attention to the development of new products or new markets during good times, but to wait until conditions are poor and then feverishly try to bring out something new to stimulate buying. When business is booming manufacturers appear to have interest in only one thing, and that is "making hay while the sun shines."

Today there is a new element in the picture—the excess profits tax. To engage in market research, in product development and finally in marketing a new device during poor times is very expensive, but today, by sharing this cost with the government through lower taxes, this groundwork can be laid for future markets at a fraction of what it would cost at any other time.

At first glance this might look like an unpatriotic thing to do; that what it amounts to is tax evasion. As a matter of fact, if one is willing to take a long, rather than a short, term viewpoint it will be found to be very patriotic on two points. The most serious threat to our national well-being during the past decade has been unemployment. By developing products now that will create a market after the defense boom is over we can have continued employment. Also, the mounting national debt will necessitate high taxes long after the current business cycle is over. Anything that is done now to prevent or minimize an ensuing depression will help the national treasury when it will need it more than now.

An executive of one of the leading electrical manufacturers told us recently that he was not permitting his company to neglect in the slightest the development of new products for the peace-time market. This manufacturer expects when the defense market is over to be able to substitute for war orders a volume of business from markets that did not exist in 1940.

Electrical manufacturers who do not expect to be caught napping when the tide of business begins to ebb will not permit the present rush of orders to dull their interest in new product and new markets development.

# Power No Factor in Willkie Defeat

By CARTER FIELD

**This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him**

WHY did President Roosevelt win?

You can hear lots of reasons, many of them logical and persuasive. So far, however, this writer has not heard any one say that any other candidate than Wendell Willkie would have made a better race against FDR.

Think this over a minute. Doesn't it mean that the fact that Willkie has been in the electric industry was not an important factor contributing to his defeat?

Let's look back a minute. When the Taft, Dewey, Vandenberg and Gannett forces were attacking Willkie, in the convention battle, they used two arguments to the delegates. These were:

1. That the country would never elect a utility holding company man.

2. That Willkie was an amateur, did not understand politics or politicians, and hence would make a weak campaign.

Much more stress was laid then on No. 1 than on No. 2.

### *Explanations*

In the aftermath discussions since election two explanations are being given by Republican politicians.

1. That Roosevelt was unbeatable. This one divides into various subheads, such as (a) conviction by the workers and the destitute that Roosevelt is their friend, and his opponents are their enemies; (b) FDR's radio voice; (c) relief and farm checks; (d) international situation; (e) more jobs and spending as a result of war buying; (f) politically strategic distribution of defense orders in pivotal states, etc.

2. That Wendell Willkie ran the campaign as a one-man show, ignoring the organizations in many states.

Of these, the first is so much more important than the second that many astute political observers discount the importance of No. 2, some of them not even mentioning it as a contributing factor.

Observe that comment today ignores the more important No. 1 of the battle for the nomination.

Virtually without exception observers agree that Willkie made a magnificent race. Further, it doubtful if the same amount of zeal for his "crusade" on the part of innumerable amateurs could have been roused for any other candidate. It certainly would have been less for the type of organization candidate some politicians would have preferred. Besides, there is no convincing evidence that any of the regular Republican leaders did not do their utmost.

The tremendously significant fact to those engaged in the electric industry is that no one now believes the attacks made by the New Dealers on Willkie's connection with a utility holding company had any important effect.

### *Nebraska*

Even in the home state of the No. 1 advocate of public ownership of the utilities of the entire country, Nebraska, these attacks were not effectual. Nebraska is close to the top, from a proportionate vote standpoint, of the ten Willkie states. It far surpassed every other Willkie state except Kansas.

Yet Nebraska has had a better opportunity to study federal aid to local power projects than any other state in the union except Tennessee. It has also had proportionately more federal "pork" on hydro developments than any other except the one from which TVA takes its name.

### *In Spite of Norris*

On top of that, there is the known fact that the voters of Nebraska have a very high regard for Senator Norris. Four years ago they re-elected him as an independent after he had declined to seek the nomination of either of the major parties. Norris' personal honesty is a tradition in Nebraska. It has been electing him, first to the House and later in the Senate, for a generation, despite the most desperate efforts of his political opponents, in both parties, to get rid of him.

Yet with Norris crusading this year against Willkie as a power baron, as an opponent of public ownership, and as the representative of the vested interests, Nebraska went overwhelmingly for the Republican nominee.

### *Tennessee*

Willkie's activities in the electric industry which happen to have been most criticised were those in Tennessee and Michigan. A study of the Tennessee situation is interesting. Seven of the eight leading newspapers of the state (selection of these leading papers were made by *Time* magazine) supported Willkie, though surely their editors were not unaware of his "benefits" of public power federally subsidized, nor had they been kept ignorant of the alleged misdeeds of Mr. Willkie.

Nor was the Democratic majority in Tennessee, in contrast with other Southern states, anything for a public ownership man to brag about.

Michigan was one of the ten Willkie states! Yet it elected a Democratic governor by a substantial margin.

There seems little reason for any one in the electric industry to hang his head in shame about this election!

# NEWS OF THE WEEK

## Public Ownership Gains In Pacific Northwest

***Washington rejects Initiative 139 as six counties reject and four favor PUD proposals in November 5 election — Oregon voters split on propositions of public power***

Public ownership and operations of electric utility facilities in the Pacific Northwest, under the sponsorship of the government's two giant hydro-electric projects—Bonneville and Grand Coulee—found the people of the area still widely divided after the November 5 elections.

Voters in the state of Washington emphatically expressed themselves for public power when they rejected by a three to two majority Initiative 139, which would force PUD directors to get a favorable vote of the residents before issuing bonds. Six counties in Washington rejected PUD proposals, while four counties favored them.

### *Defeat in Spokane*

The defeat in Spokane, the largest to be voted in the state, was regarded as a particularly crushing blow to the public ownership movement, following so closely on the heels of a similar defeat in Portland, Ore., last May. The vote was nearly two to one. Adams and Asotin counties also rejected PUD proposals. The Asotin defeat came while federal engineers were making surveys for a projected $3,270,000 transmission line into the area to carry Bonneville-Grand Coulee power. Adams county voters defeated a similar proposal two years ago. Washington Water Power Co. operates in Spokane, Adams and Asotin counties.

Two counties in the Puget Sound area likewise turned down PUD proposals, King County, in which Seattle is situated, but with the PUD confined to territory outside of Seattle, and Island County.

Kitsap County returned a majority in favor of public ownership, 3,460 to 2,931. Clallam and Jefferson counties favored PUD proposals by a combined vote of 5,409 to 3,359. Puget Sound Power & Light is the chief private utility serving parts of all these counties.

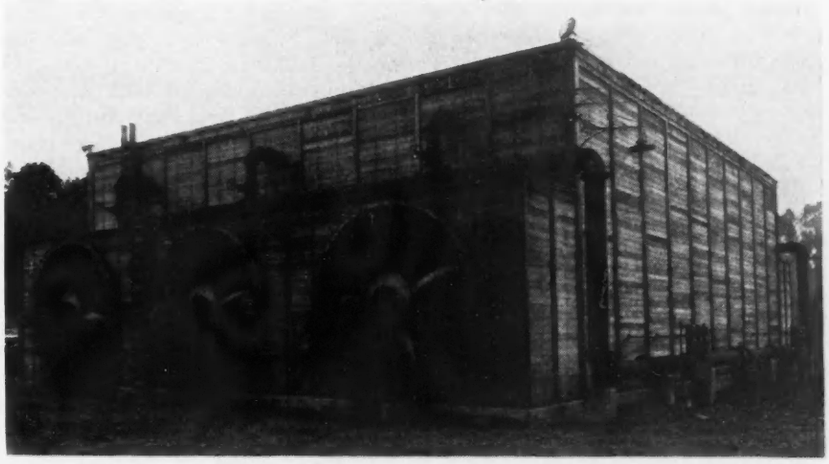
In territory served by Pacific Power & Light, Yakima favored a PUD by a close margin after rejecting it in three previous elections. Columbia County, on incomplete returns, appears to have rejected the PUD idea.

Six large counties and one fraction of a county in Oregon turned down proposals to form PUDs. At the same time PUD proposals in six fractions of other counties were successful.

### *Counties Reject PUD*

Counties rejecting PUDs were Clackamas, Marion, Polk and Washington, served by Portland General Electric Co.; Lane and Coos, served by Mountain States Power Co., and a parcel of Crook, served by Pacific Power & Light. The Crook County parcel was a part of a large district in central Oregon composed also of parts of Deschutes and Jefferson counties which favored the PUD proposal, but under Oregon law the Hydro-Electric Commission must determine if the two can form a district without Crook County.

Other districts in which PUD forma-



**COOLING TOWER—Circulating water is sub-cooled by this Foster-Wheeler tower, added not long since to the steam plant facilities of the Fitchburg (Mass.) Gas & Electric Light Co. Operating in parallel with the variable flow Nashua River, the installation has a capacity of 7,500 g.p.m. There are six sections, each served by a 12-ft. fan driven by a 26-hp., 575-volt, three-phase induction motor controlled from the nearby station. A 100-hp. vertical motor-driven pump delivers the warm circulating water to the tower, whence it flows by gravity back to the condenser equipment in the plant. In winter the river suffices for the supply of condensing water**

**LIGHTING CONFERENCE—A registered attendance of 923 was reported at the recent fluorescent lighting conference sponsored by Duquesne Light Co. in Pittsburgh. Lamp and fixture manufacturers participated and exhibited latest developments.**

tion was favored were a small portion of Columbia County, served by Portland General Electric and Northwestern Electric; town of Clatskania and a small portion of Lincoln County, both served by West Coast Power Co., and Union County, served by Eastern Oregon Light & Power Co.

***Vote Bond Issues***

Four districts already formed voted favorably on the issuance of revenue bonds for the purpose of buying out existing private systems or otherwise providing their own distribution systems. The issues voted included Wickiup PUD, area served by Pacific Power & Light, $80,000; Tillamook PUD, served by Mountain States Power, $750,000; Wasco County PUD, including The Dalles, served by Pacific Power & Light, $475,000; Nehalem Valley PUD, served by Oregon Gas & Electric, $210,000.

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## Defeats Hydro Proposal

A proposal that Geneva County, Alabama, construct a $3,000,000 hydroelectric project on the Choctawatchee River, financed by RFC, was defeated in the November 5 election by 1,309 to 1,190. Probate Judge P. C. Black said that the proposition would be submitted again as he did not believe the voters "properly understood the question," especially the point that the debt would not be a direct obligation of the county.

## Fluorescent Lighting Meet in Pittsburgh

An interesting and successful two-day customer fluorescent lighting conference, sponsored by the Duquesne Light Co., was recently held in Pittsburgh and drew a 923 registered attendance. Participating in the exhibit were General Electric, Westinghouse, Benjamin Electric Manufacturing Co., F. W. Wakefield Co., Edwin F. Guth Co., Curtis Lighting Co., Inc., Fostoria Pressed Steel Corp., the Miller Company, Daybrite Lighting Co., Inc., Mitchell Manufacturing Co. and Duquesne Light Co.

Featured speaker on both days was "Jim" Ketch of Nela Park. He stressed the benefits of good lighting for commercial establishments and for industrials.

Others taking part in the program included G. W. Ousler, general sales manager of Duquesne Light Co.; E. D. Altree of General Electric Lamp Co.; Al Paulus, Westinghouse Lamp Co.; L. J. Lamberger and F. A. Kolb of Duquesne Light Co.

The purpose of the meeting was to make it possible for customers interested in fluorescent lighting to inspect the latest fixtures of the leading manufacturers. It was designed to capitalize on the widespread interest in this new lighting tool and to advise customers of the many benefits available by the proper application of the fluorescent lamp. The keynote of the conference was the opportunity to "build up" foot-candle intensities to levels which heretofore were impractical with incandescent lighting.

# NEWS BRIEFS

"Since the rule is that progress cannot be stayed at the call of decadence," the Arkansas Supreme Court has ruled that a rural electric line, constructed in an approved manner and maintained properly, cannot be held responsible for interference with an "improperly constructed" telephone line.

Mayor Angelo Rossi of San Francisco has completed negotiations with Pacific Gas & Electric on an amended leasing plan for municipal distribution of Hetch Hetchy power. This is another attempt to appease Secretary Ickes and settle the troublesome problem.

The Electric Association of the Niagara Frontier has started its sixth annual commercial and industrial lighting sales contest. It runs for eight weeks and is open to salesmen of wholesalers, contractors, dealers and power companies members of the association. All 1939 winners are in a contest by themselves, non-winners and newcomers in another.

Westinghouse has increased transformer production at its Sharon Works to meet requirements of the national defense program.

Irvin "Pat" Poste, St. Lawrence Power Co., who saved the life of a fellow employee last June by resuscitating him after he had touched a high-tension wire, was presented with the Canadian Electrical Association's resuscitation medal and a certificate in a recent ceremony at Cornwall, Ont. The medal is made of copper from the first high-tension power line in the British Empire. Company officials attended the ceremony.

Allis-Chalmers plans many interesting new features for prominent display at the New York Power Show, December 2-7. The new "Electrifugal" pump is to be featured.

The Georgia Municipal Association is asking for an amendment to the state Constitution to pave the way for municipal ownership and distribution of power.

Lebanon, Tenn., is making a survey to investigate the practicability and cost of a steam generating plant.

Utility tax collections which go to unemployment relief in Illinois represented 4.25 cents of every tax dollar collected during the 1940 fiscal year.

# Engineering Experiences Discussed at P.E.A. Meet

***Self-supporting cable and aerial counterpoise among topics aired by transmission and distribution committee of association—Progress in operations reported***

Self-supporting cable, aerial counterpoise and capacitors were dominant topics at the two-day meeting of the transmission and distribution committee of the Pennsylvania Electric Association at Harrisburg last week.

Three miles of General Electric messengerless cable in Philadelphia is affording an answer to protected feed to load center in heavily treed area. It costs about half as much as lead cable with messenger, hardware and splices have been developed and the installation, said S. H. Troxel, functioned without resplicing after a snow-laden tree brought it and two poles down.

### *Removing Steel Crossarms*

Duquesne Light, reported R. W. Mavity, is removing steel crossarms from 25 miles of 66-kv. towers this year (25 more next year) and replacing with double-plank framed wood arms to get a 1,600-kv. impulse strength on the Pittsburgh ring. The ground wires are going up to a 25-ft. height above conductors and a $\frac{7}{16}$-in. Copperweld counterpoise is being installed aerially below the conductors.

W. H. Jones, chairman (Philadelphia Electric), reported that an analysis of lightning failures of 87,812 transformers in Pennsylvania showed a value of 0.71 per hundred for 1939, better by 0.10 than 1938. The small ones are most vulnerable. Fuse blowing is worst with non-interconnected neutrals. Inquiry showed a majority favoring use of 15-amp. or larger fuses.

F. M. Starr (General Electric) in covering capacitor applications said the 1940 rate was ten times that of 1929 and the last six months have seen a sharp increase, several companies now buying in 10,000-kva. lots. The prices per kva. are cheapest in the 460–7,800-volt range. Rural lines give lower ratio of released capacity with shunt capacitors, but a kva. is worth more there than in urban districts. He argued that there is infrequent justification for switching capacitors on and off automatically.

C. C. Moler (Potomac Edison) and M. M. DeVorris (Pennsylvania Edison) both reported balky behavior of large air-compressor motors in railway shops when attempt was made to correct flicker by installing series capacitors. Moler corrected a sub-synchronous lock-in by putting 40 ohms of resistance across the units. He added that protective equipment had lost no units in eight unit years of series capacitor service. Philadelphia is installing a transformer-coupled series capacitor.

Discussion showed mixed and conflicting experience with reclosing devices, with hopeful anticipation of new devices in development. Some said there is still not enough positive time delay for reclosure.

### *Wax-Melting Device*

Using a Maximeter for a 24-hour run, a lineman and an engineer determine the loading on twelve to fifteen transformers per day on West Penn, stated J. S. Maloy. In one district they found one-third of the transformer overloaded. One company is developing a wax-melting device for indicating 100 and 140 per cent loading. A cautious attitude was manifested toward banking of secondaries.

Comprehensive pole testing on one property has revealed a leaching out of ZMA and a fiber brittleness after ten years of pole service. Two-thirds of next year's poles on that property will have Osmose treatment. Some adverse experience with top-treated insulators was reported, noise going up to 20 times in six months, apparently due to sunlight and surface reticulation.

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## Wins Ad Award

Consolidated Edison Co. of New York, Inc., has won first place in the 1939-40 competition to determine the best public utility advertising in the United States and Canada. The competition was the twelfth annual one conducted by Vincent Edwards & Co. Awards were also made to 29 other winning companies.

**P.E.A. MEETING—Attending the meeting last week in Harrisburg of the T.&D. committee of the Pennsylvania Electric Association were, l. to r. (seated), John T. Mason, C. N. Clark, W. H. Jones, chairman; J. S. Maloy, E. A. Zehfuss, Eduard Fritz, Jr., P. H. Robbins, W. H. Frederick, S. H. Troxel; (standing) R. W. Mavity, K. A. Cottom, G. S. Van Antwerp, J. G. Charest, L. L. Bradford, R. M. Zimmerman, M. J. Urner, R. J. Phillips, C. C. Farrell, C. C. Moler, W. M. Devorris, J. W. Anderson, and A. E. Knowlton**

# Drastic Reforms Seen Need In Utility Industry

***Standard Gas & Electric chairman asks government and industry to sit down together to work out problems of the utilities — Responsibility seen to protect the public***

Drastic financial reorganization of holding and operating utility companies that are burdened with huge preferred stock dividend arrearages is inevitable, Leo T. Crowley, chairman of the Federal Deposit Insurance Corp. and chairman of Standard Gas & Electric Co., told the annual convention of the Wisconsin Utilities Association this week in Milwaukee.

Mr. Crowley's first "full-dress" utility speech presages his early retirement from the New Deal post to devote full time to his utility business. Mr. Crowley is known to have his resignation from FDIC ready to hand to President Roosevelt at the first opportunity, since the arrangement was for him to remain in office until after the election. He has been serving without federal pay since he was elected to the utility job.

### *Need for Reforms*

Drawing a parallel with the banking reforms which have been put into effect, Mr. Crowley said that no one denies the need for extensive reform of organization and practice in the utility industry. "We are generally agreed that such practices as the arbitrary write-up, overcapitalization, skimping on depreciation and otherwise using improper accounting methods can no longer be tolerated."

It was pointed out by Mr. Crowley that "it is likewise evident that the day of pyramiding corporate structures, extortionate service, management, and construction contracts with subsidiaries, and unjustifiable inequalities in the distribution of voting control is drawing to an end. Our differences, as I see it, are not with the subject matter of reform, but rather with the manner and the extent of its achievement.

Mr. Crowley said that "here we are with a job of work to be done, under a statute that some of us consider too strict, others too lenient. But the job is urgent and the law is on the books. Let's sit down with those charged with administering the law and work out programs for accomplishing as much of our job as we can in conscience under existing law. I believe that this approach will work out many more of our differences that we now think possible. And if it develops that we cannot thus resolve all differences, then at least Congress and the responsible government officials will know that the difficulties which remain have not been exaggerated by the industry. Such cooperation between industry and government should quickly add to the effectiveness of both legislation and administration."

### *Cites Dividend Arrears*

As to the financial condition of the utility industry, Mr. Crowley said that on the basis of the latest published figures (as of January 1, 1938), out of 158 holding companies having outstanding preferred stocks with a par or liquidating value of about $2,400,000,000, there were 48 companies with outstanding preferred stock in the hands of the public amounting to $1,331,000,000 which were in arrears as to dividends to the extent of about $337,000,000—the arrears amounting to 25 per cent of par value of the stocks.

Among the operating subsidiaries of registered holding companies there were 224 companies with preferred stocks in the hands of the public amounting to $1,447,500,000. Of these, Mr. Crowley said, 70 companies had accumulated arrearages of about $96,000,000 on their outstanding preferred stocks in the amount of $443,000,000. "Thus more than 30 per cent of the preferred stocks of operating companies was in arrears to the extent of 21.6 per cent."

While the picture has improved during the intervening three years, Mr. Crowley said, the magnitude of the problem is still considerable.

In the utility industry, as in the banks, Mr. Crowley said, the government has a clear and definite responsibility to protect the public from dissipation of its wealth by corporations whose existence government sanctions, and the extent of supervision always has depended upon the degree to which management itself recognized and regarded the public interest."

## Floating Power Plants Seen Aid in Emergency

**Floating power plants which can be towed through America's coastal and inland waterways and hooked up to regular distribution lines to generate electricity in an emergency may be a factor in the national defense program, A. P. Kellogg of the General Electric turbine division told the Wisconsin Utilities Association this week.**

**Speaking before the convention in Milwaukee, Mr. Kellogg said that a 50,000-kw. self-contained floating power plant is being studied by his company. This seems to be the largest rating practicable, he declared.**

## Will Shift Control of Standard Gas

Securities and Exchange Commission has announced that Standard Power & Light Corp. has filed an application with regard to a plan to divest itself of control over Standard Gas & Electric Co., to simplify its corporate structure, and to transform itself into an investment trust.

To divest itself of control over Standard Gas & Electric the corporation has three alternative plans as follows:

1. Corporation will exchange its 1,160,000 shares of common stock of the company for an equal number of shares of nonvoting stock, but having the same rights as to dividends and assets as the voting stock. Corporation will agree that so long as it holds any notes, debentures, prior preference stock, or $4 cumulative preferred stock of the company, it will not vote for the election of directors.
2. Corporation will agree that so long as it holds any securities of the company it will refrain from voting for the election of directors.
3. Corporation will surrender for cancellation the certificates for 1,160,000 shares of common stock of Standard Gas & Electric Co., with the reservation that it will receive an appropriate share of the assets of the company upon any distribution of assets. Corporation will agree not to vote any of the other securities for the election of directors of the company.

Standard Power & Light Corp. proposes to simplify its corporate structure by creating a new class of common stock which will be issued in exchange for its outstanding preferred stock, common stock and common stock, series B. There will be 800,000 shares of the new common stock created with a $5 par value each. Each share will be entitled to one vote.

Each share of outstanding preferred stock, together with all accumulated dividends, will receive 20 shares of new common stock and each of 30 shares of common stock and common stock, series B, will receive one share of the new common stock. The present preferred stockholders will receive 681,080 shares of new common stock, or 92.1 per cent, and holders of the present common stock and common stock, series B, will receive 58,666 ⅔ shares, or 7.9 per cent.

# Commonwealth & Southern to Add to Power Supply

***Utility system will increase generating capacity 110,000 kw. in year at cost of $9,000,000 — Work progressing on 260,000 kw. now being installed — Whiting surveys 1941 needs***

Tentative plans for the construction of 110,000 kw. of additional generating capacity are being considered by Commonwealth & Southern Corp. It is contemplated that of this amount 70,000 kw. will be located in the north and 40,000 kw. in the south.

While details as to the exact location and time of completion are not as yet worked out, it is estimated that the new facilities now under consideration will cost approximately $9,000,000 and should be ready for operation during 1942. The addition of these new facilities will increase the generating capacity of the system by 22 per cent over that of 1939 and bring the total generating capacity up to 2,480,000 kw.

### *Two New Units*

Two 35,000-kw. units were put into operation this year, one in April at the new John C. Weadock steam-electric plant on Saginaw Bay near Bay City, Mich., of Consumers Power Co., and the other in the Toronto plant of Ohio Edison Co. last October.

In addition to the above projects, work is progressing rapidly on 260,000 kw. of additional capacity which is scheduled for completion in 1941.

Another 35,000-kw. unit is to be added to the John C. Weadock plant and will go into operation in June, 1941.

The Bryce E. Morrow steam-electric generating plant of Consumers Power Co. near Kalamazoo will also add another 50,000 kw. unit, which is expected to be put into operation in August, 1941.

An extension to the East Peoria station will add 35,000 kw. to the capacity of Central Illinois Light Co. Completion of this addition is scheduled for June, 1941.

Construction of a new plant at Mobile of Alabama Power Co. is progressing rapidly and is expected to be completed for the 40,000-kw. unit to be in service by June, 1941.

Georgia Power Co. is now constructing a new station at Macon with an initial installation of a 40,000-kw. unit. This will be completed and put in service by May, 1941.

The construction of an additional 60,000-kw. turbo-generator unit at the Atkinson generating plant of Georgia Power Co. in Atlanta is progressing rapidly, company officials report. This unit is expected to be in operation by November, 1941.

Justin R. Whiting, president of Commonwealth & Southern Corp., is now on an inspection tour of the system properties consulting with operating officials as to budget needs for next year.

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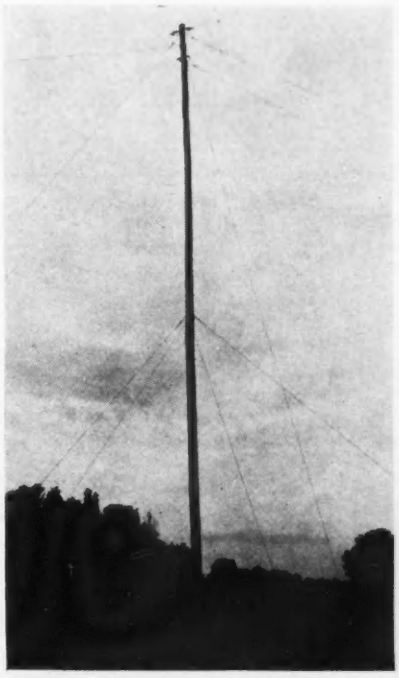
## Single Poles Support 2,225-Ft. River Span

What is believed to be the longest river crossing ever constructed using only single poles to support more than one conductor in a vertical plane has just been completed for an REA project in Arkansas. The 2,225-ft. span is considered unusual in many respects.

The line was constructed for the First Electric Co-operative Corp. and crosses the Arkansas River at Perry and Faulkner counties. The crossing is doubly unusual in that one bank of the river has a zero elevation at high water; the other bank is a 160-ft. cliff. The War Department requires a 62-ft. minimum clearance.



**POLE LINE—Perry County side of the 2,225-ft. span across the Arkansas River showing the 100-ft. spliced pole**

After several plans proved ineffective, final solution was a 35-ft. class 1, Southern yellow pine pole set in a rock bluff on the upstream side, guyed with four $\frac{7}{16}$-in. guys, and a spliced pole reaching 90 ft. above high water on the low side. A 60-ft. class 1 and a 55-ft. class 5 pole were fastened with a 15-ft. splice. The top of the longer pole and the bottom of the shorter were about the same diameter. The poles were cut and joined with four bolts 1 in. in diameter and nine bands of ½ x 2-in. steel. This structure is guyed with four $\frac{7}{16}$-in. guys at the splice and four more near the top. This pole is set at a 10-ft. depth.

A single pole could not be used on the low side because of difficulty in locating a pole long enough and in finding a plant to creosote it. REA has used this splice type of construction elsewhere with considerable success.

Special steel wire, manufactured by the Indiana Steel & Wire Co., was used for the crossing. Although weighing only 205 lb. per 1,000 ft., this wire can withstand 11,000 lb. tension. The conductor is $\frac{5}{16}$-in. extra high strength, seven-strand steel. It was sagged to a tension of 1,920 lb. at 95 deg. F. and has a sag of 26.5 ft. below the top of the lower support.

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## Electrical Engineers Get Questionnaire

Electrical engineers of the nation shortly will receive a general questionnaire and technical check list from the National Roster of Scientific and Specialized Personnel in Washington. Purpose of this survey—being conducted in all lines of professions and specialized knowledge fields—is to establish a central register of persons professionally competent readily available for consideration of needs arising from the national preparedness program.

The roster is being compiled jointly by the National Resources Planning Board and the Civil Service Commission. Dr. Leonard Carmichael, president of Tufts College, is director and James C. O'Brien of the Civil Service Commission is executive officer. Co-operating are all the professional societies.

Fundamentally, the aim is the development of a means not only for the efficient and rapid but appropriate use of the specialized brain power of the nation.

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## Sale of Lamps

During the first ten months this year Georgia Power Co. sold 566,138 Mazda bulbs and 10,725 I.E.S. lamps.

## I.E.S. to Hold Next Meeting in Atlanta

Constitutional changes creating eight new regional divisions of the Illuminating Engineering Society and the new regional plan is now in operation. The eight vice-presidents, chosen by the nominating committee and confirmed by the council, have assumed their duties.

The following officials will serve for a one-year term:

Region A, comprising Toronto Section and Montreal chapter, and non-section territory throughout Canada—R. M. Lowe, Canadian General Electric Co., Toronto.

Region B, comprising New England and New York sections—Oscar P. Cleaver, Westinghouse Lamp Division, Bloomfield, N. J.

Region C, comprising Philadelphia and Pittsburgh sections and the Baltimore-Washington chapter—A. S. Turner, Jr., General Electric Co., Philadelphia.

Region D, comprising Western New York, Cleveland, Ohio Valley and Michigan sections—A. F. Wakefield, F. W. Wakefield Brass Co., Vermilion, Ohio.

Region E, Comprising the southeastern section of the United States including the Georgia and New Orleans chapters—Roy A. Palmer, Duke Power Co., Charlotte, N. C.

Region F, comprising Chicago, Twin City sections and the Nebraska-Iowa, Heart of America and Spirit of St. Louis chapters—Norman B. Hickox, Civic Opera Building, Chicago.

Region G, comprising the southwestern section of the United States, including the Southwestern Section I. E. S.—P. M. Rutherford, Dallas Power & Light Co., Dallas, Texas.

Region H, comprising Pacific Coast area including the Southern California and the San Francisco Bay Cities sections—Frank A. Hansen, Western Institute of Light and Vision, Los Angeles, Calif.

It was said that one of the first direct results of the new regional plan is the organization of a new chapter in the state of Washington.

It was announced that the 1941 convention is to be held in Atlanta, Ga., September 22–25, with headquarters at the Atlanta-Biltmore Hotel. Philip Peeples, Georgia Power Co., will serve as chairman of the local convention executive committee.

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## Mexico Completes Dam

Construction of a great dam on the Bavispe River at Angostura, in northwestern Mexico, has been completed by the Mexican Irrigation Commission at a cost of $30,000,000, as measured in American currency. It is the greatest water storage and irrigation project ever undertaken in the country. When the proposed hydro-electric equipment is installed power will be generated and distributed over a wide area.

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## $12,000,000 Development Authorized by Ontario

Hydro developments involving the Ogoki diversion and a 54,000 hp. plant on the Madawaska River at a total estimated cost of $12,000,000, have been authorized by the Ontario Cabinet.

The Madawaska project calls for a power house at Barrett Chute, 30 miles west of the Ottawa River and a storage dam at Bark Lake, far up the Madawaska system. It also involves an ultimate development of eight sites on the river for a total estimated 200,000 hp.

The government order gave the go-ahead signal on the Ogoki diversion as part of the new Canada-United States St. Lawrence River power project.

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## REA Line to Mines

Construction of an REA line to serve eighteen Cinnabar mines in Arkansas and 403 farmer-members is now in progress, following the allocation of $240,000 to the Southwest Arkansas Electric Co-operative Corp., Texarkana. Eighteen miles of 33,000-volt transmission line into the mine area and 26 miles of 13,200-volt, three-phase distribution line to bring power to the individual mines are scheduled for completion this month. Mercury is extracted from the ore.

## MEETINGS

**American Society of Mechanical Engineers**—Annual meeting, New York, N. Y., December 2-5. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

**American Society of Agricultural Engineers**—Fall meeting, Chicago, Ill., December 2-6.

**National Exposition of Power and Mechanical Engineering**—Grand Central Palace, New York N. Y., December 2-7.

**National Association of Railroad and Utilities Commissioners**—Annual convention, Hotel Miami-Biltmore, Miami, Fla., December 10-12. Clyde S. Bailey, secretary, New Post Office Bldg., Washington, D. C.

**National Chemical Exposition** — Sponsored by Chicago Section American Chemical Society, Stevens Hotel, Chicago, December 11-15.

**Petroleum Electric Power Association**—Annual conference, Hotel Heidelberg, Baton Rouge, La., December 12-13. G. H. Weckel, secretary, Kansas Gas & Electric Co., Wichita, Kans., and James Hodge, Gulf States Utilities Co., Baton Rouge, La.

**American Institute of Electrical Engineers** — Winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

## Utility System Speeds Power Capacity Work

The growing effect of national defense preparedness upon the business and earnings of the North American System is reflected in the third quarter report. Electric output of operating companies surpassed all records for previous quarterly periods and plant facilities responded to increasing industrial activity in the areas served, according to E. L. Shea, president.

Mr. Shea said that "it is our responsibility to see to it that our operating companies are financed and equipped to provide and maintain an adequate electric power supply for that part of America's preparedness program that is going forward in their territories.

"Our programs for meeting this responsibility are proceeding on schedule," Mr. Shea declared. "Although our companies already had ample facilities to meet increasing demands for electric service, they are nevertheless enlarging their construction programs in order to provide power for unusual demands and even extreme emergencies which might occur in the future.

"We are not only carrying out our national defense obligations as far as our system's physical facilities are concerned, but the company and its stockholders—through the increased taxes we now pay—are in addition playing a substantial part in financing the overall national effort. This already is apparent in the effect upon our earnings of the higher federal tax rates which are retroactive to the beginning of the current year."

Mr. Shea reported an increase of $4,000,000 in taxes for the twelve months ended September 30, equivalent to 17.75 per cent of total revenue, or $2.65 a share on the common stock. Income taxes are up 84 per cent. Earnings were equal to $1.99 a share, against $1.94 a share in the preceding year.

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## Whiting Named to E.E.I.

Justin R. Whiting, president of Commonwealth & Southern Corp. and chairman of Consumers Power Co., has been elected a trustee of the Edison Electric Institute to succeed Wendell L. Willkie, who resigned all his business positions when he accepted the Republican Presidential nomination.

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## Inland Power Trustee

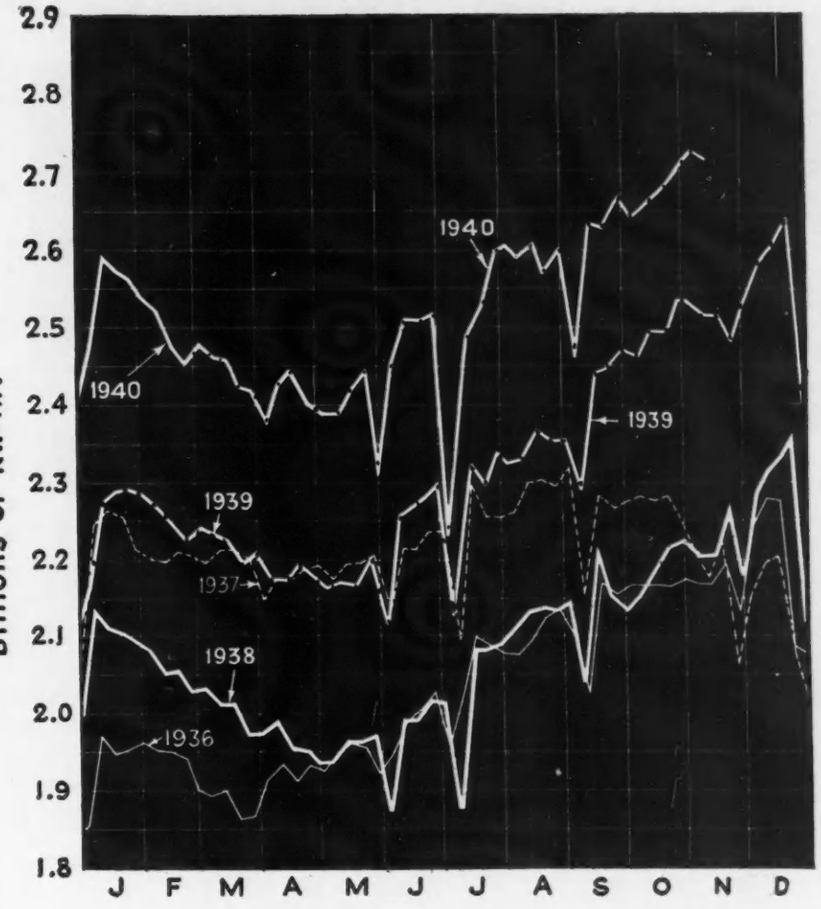
John E. Dwyer, retired business man, has succeeded Leonard Florsheim as trustee of the Inland Power & Light Corp., which is in the process of reorganization.

## Output Dip Reflects Election Holiday

Reflecting the election day holiday, production of electricity by the electric light and power industry dipped in the week ended November 9 from the all-time high established in the preceding week to 2,719,501,000 kw.-hr., according to the Edison Electric Institute. The gain over the corresponding week of a year ago, however, increased to 8.2 per cent.

Output in the most recent week was about 23.1 per cent ahead of the corresponding week of 1938 and 25.0 per cent ahead of 1937. For the remainder of the year the margin over 1937 will be greater than that over 1938—unlike the earlier part of 1940—since it was about this time in 1937 that the energy curve began its downward plunge.

Although most of the major geographic regions showed decreases in percentage changes from 1939 in the week ended November 9 from the preceding week, in the Central Industrial region the margin was increased from 10.3 per cent to 10.6 per cent, a probable indication of stepped-up industrial activity over a year ago.




**Weekly Output, Millions Kw.Hr.**

| 1940 | | 1939 | | 1937 | |
|---|---|---|---|---|---|
| Nov. 9 | 2,720 | Nov. 11 | 2,514 | Nov. 13 | 2,177 |
| Nov. 2 | 2,734 | Nov. 4 | 2,537 | Nov. 6 | 2,202 |
| Oct. 26 | 2,711 | Oct. 28 | 2,539 | Oct. 30 | 2,255 |
| Oct. 19 | 2,687 | Oct. 21 | 2,494 | Oct. 23 | 2,282 |
| Oct. 12 | 2,665 | Oct. 14 | 2,495 | Oct. 16 | 2,276 |
| Oct. 5 | 2,641 | Oct. 7 | 2,465 | Oct. 9 | 2,280 |
| Sept. 28 | 2,670 | Sept. 30 | 2,470 | Oct. 2 | 2,276 |
| Sept. 21 | 2,629 | Sept. 23 | 2,449 | Sept. 25 | 2,266 |

**Per cent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | Nov. 9 | Nov. 2 | Oct. 26 |
| New England | + 5.5 | + 6.1 | + 3.7 |
| Middle Atlantic | + 6.5 | + 7.3 | + 5.6 |
| Central Industrial | +10.6 | +10.3 | + 9.2 |
| West Central | + 5.4 | + 6.5 | + 5.4 |
| Southern States | + 9.2 | +10.1 | + 6.9 |
| Rocky Mountain | + 2.2 | — 0.8 | + 0.4 |
| Pacific | + 4.5 | + 2.7 | + 7.2 |
| United States | + 8.2 | + 7.8 | + 6.8 |

## Cowlitz County PUD to Buy Washington Utility Units

Cowlitz County Public Utility District, according to Chairman W. A. Cardwell, has taken steps for early acquisition of the Longview and Ryderwood properties of Washington Gas & Electric Co. Arrangements have been completed to deposit $6,011,056, the amount of a condemnation award fixed by a federal jury last April, plus 6 per cent since the decision.

The district board has decided to acquire the properties of Northwestern Electric Co. in Kalama and Woodward provided the Clark County District completed negotiations for the company's system.

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## To Aid Utility Trustees

Carlos I. Israels, who has been associated with the law firm of White & Case since 1928, has been appointed by Federal Judge Vincent L. Leibell to the legal staff of the trustees of Associated Gas & Electric Corp. Mr. Israels will specialize in the technical phases of the utility organization under Allen E. Throop, general counsel.

## New 25,000-Kw. Plant for Kentucky Utilities

**Kentucky Utilities Co. plans to build a new steam-electric generating plant on the Kentucky River near Tyrone, with an initial capacity of 25,000 kw., costing about $3,000,000, Robert M. Watt, president, announced this week.**

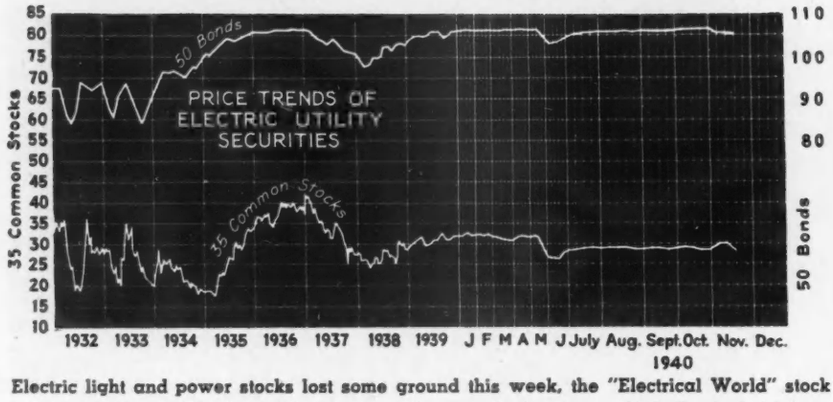
**The proposed plant is to be linked with the company's Eastern power transmission system and Dix Dam hydro-electric station. It also will be linked with power houses in Louisville, and through them with plants in Indiana and Ohio. Construction will require two years.**

## P. G. & E. Hydro Petitions Dismissed by Board

Federal Power Commission has dismissed, without prejudice, the application of the Pacific Gas & Electric Co. for a license to construct two large hydro-electric projects on the North Fork of the Feather River in Butte and Plumas counties, Calif., holding that a comprehensive development of the water resources of North Fork cannot be made without the inclusion of the storage reservoir at Lake Almanor in a proper license.

The commission also has dismissed, as no longer necessary, the company's application for a preliminary permit covering six possible power plant sites on the North Fork, because a license is sought for two of them. The two involved in the license application are the proposed Cresta development, estimated by the applicant to cost $9,590,000 for plant and transmission lines, and the Pulga development, estimated to cost $9,300,000.

## Stocks Move Downward; Bonds Hold Firm


50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
35 Common Stocks
35 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1932 1933 1934 1935 1936 1937 1938 1939 J F M A M J July Aug. Sept. Oct. Nov. Dec. 1940

**Electric light and power stocks lost some ground this week, the "Electrical World" stock index receding to 28.4 from 29.7 the preceding week; last year, 31.7. Bonds held firm, the index turning upward—106.1; last week, 106.0**

## Middle West Files Stock Change Plan

Middle West Corp. and its subsidiary, North West Utilities Co., have filed with SEC declarations and an application regarding a $260,531 capital contribution by the parent company to the subsidiary by surrendering for cancellation all outstanding common stock of the subsidiary.

North West Utilities proposes to change its 84,755 shares of preferred stock, part of which are without par value and part having a $100 par value, into an equal number of shares of new common stock of $70 par value. The company will decrease its capital from $8,346,031, now represented by outstanding preferred and common, to $5,932,850, an amount equal to the par value of the new common. The company will eliminate its existing deficit, which on September 30 amounted to $1,610,905 by charging it against the capital surplus created by the reduction in capital.

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## Will Buy Own Debentures

Permission was granted United Light & Power Co. by the SEC to buy its own debentures through open market or private purchase. Aggregate cost of the acquisitions was placed at not more than $1,000,000 by United. At the same time application of United to acquire outstanding debentures and preferred stock of two subsidiary companies was denied by the commission.

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## SEC Sets Utility Hearing

SEC will hold a public hearing in Washington, D. C., on December 4 under the Holding Company Act to determine whether a number of specified individuals and firms directly or indirectly exercise such a controlling influence over the policies of the International Utilities Corp. as to make it necessary for the protection of the public that one or more of them be subject to the obligations, duties and liabilities imposed by the act on holding companies.

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## Interstate Power Files Application for Merger

SEC has announced that Interstate Power Co. and its wholly owned subsidiary, Interstate Power Co. of Nebraska, has filed an application under the Holding Company Act for an order authorizing the merger of the subsidiary company into the parent company. The parent company will assume all the obligations of the subsidiary and will acquire all of its utility assets.

According to the application the purpose of the merger is to effect certain economies in operations and to enable the parent to more economically effect the sale of properties to be acquired from Interstate Power Co. of Nebraska.

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## Utilities to Fight Court Ruling to Refund Loans

Long Island Lighting Co. and the Empire Power Corp. will make a joint appeal on the decision handed down recently in the Supreme Court in Brooklyn, N. Y., directing the former company to repay $4,983,000 in unsecured loans made to it by Empire Power, it was announced by Stephen Callaghan, counsel for the defendants.

Suit was brought against the companies by a minority stockholder of Empire Power to compel Long Island Lighting to repay the loan. The court held that the loans were made in violation of Section 69 of the Public Service Law.

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## Utilities File Bond and Stock Issues

Boston Edison Co. has filed with the Securities and Exchange Commission a registration statement covering $53,000,000 of first mortgage bonds, series A, due 1970. Proceeds from the sale of the bonds will be applied to the redemption on or about December 30 at 107 of $53,000,000 of 3½ per cent first mortgage sinking fund bonds, series A, due 1965.

According to the registration statement, the company is required by Massachusetts law to invite proposals for the purchase of the bonds by public advertisements. The price at which the bonds will be offered to the public, the names of any underwriters and the underwriting discounts and commissions will be furnished by amendment to the registration statement. The redemption provisions also will be furnished by amendment.

Indianapolis Power & Light Co. registered with the SEC 140,591 shares of 5¼ per cent cumulative preferred stock, $100 par value. The company proposes to offer the new preferred stock to holders of its outstanding 6 per cent and 6½ per cent cumulative preferred stock on a share for share basis, plus cash equal to the difference between the redemption price of the old preferred and the initial public offering price of the new preferred. Shares not taken under the exchange offer will be offered publicly through underwriters.

Proceeds, together with treasury funds, will be applied to the redemption on January 1, 1941, at $110 per share of 115,777 shares of outstanding 6½ per cent preferred and 24,814 shares of outstanding 6 per cent preferred.

## Utility Reports

| | Net Income 1940 | 1939 |
|---|---|---|
| *Alabama Power | $3,278,860 | $3,994,747 |
| *American Water Works & Elec. and subs. | 4,257,484 | 2,655,159 |
| *Birmingham Electric | 554,235 | 559,266 |
| *California Oregon Power. | 909,265 | 886,358 |
| *El Paso Electric (Tex.) | 443,573 | 372,234 |
| *Gulf States Utilities | 2,533,907 | 2,497,840 |
| *Kansas City Power & Light | 3,787,140 | 3,807,812 |
| *Niagara Hudson Power and subs. | 7,781,200 | 7,696,871 |
| *Ohio Edison | 4,138,296 | 4,217,830 |
| *Oklahoma Gas & Electric | 2,655,849 | 2,758,461 |
| *Puget Sound Power & Light and subs. | 1,516,293 | 1,484,637 |
| *Savannah Electric & Power | 153,305 | 258,465 |
| *Virginia Electric & Power. | 4,083,223 | 3,827,703 |
| *Western Public Service and subs. | 166,238 | 170,805 |

*Twelve months ended September 30.

# We Make a Lot of Relays

# . . . and We Make 'em Alike

## That's Why We Were Able to

# REDUCE PRICES 10%

. . . on all G-E standard, normal-speed induction and auxiliary relays, effective November 1, 1940.

Continuous progress in design, a practical and extensive standardization program, and efficient production-line manufacturing methods combine to give you the important saving made possible by these new low prices.

*General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

# OPERATING PRACTICES

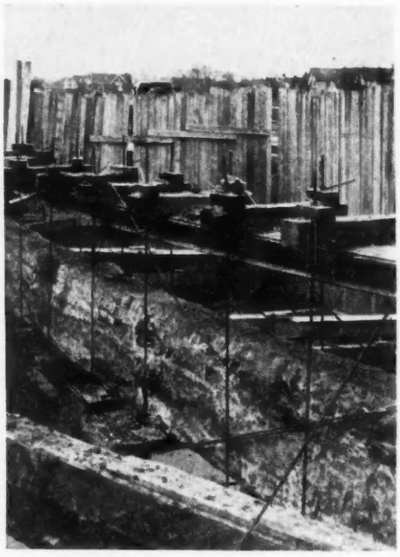
## Truss-Beam Support for Heavy Duct Line

A combined truss and beam suspension occupying but little more space than the duct line it supported was devised by engineers of the Wisconsin Electric Power Company when recent construction of a large intercepting sewer chamber under the line made its suspension necessary.

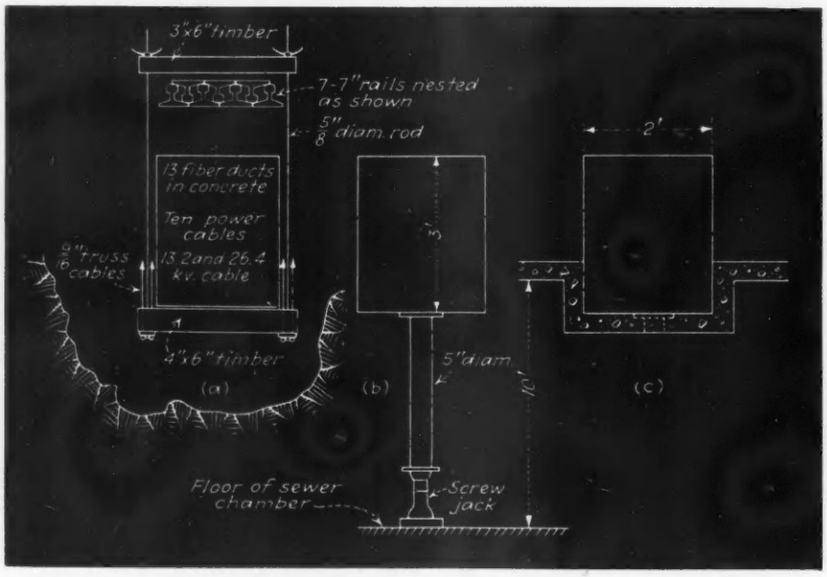
Several factors complicated the problem of supporting this duct. Excavation under and around the line with a clam shovel dictated a compact suspension and one capable of absorbing shock blows without damaging the concrete line. Weight of the 40-ft. suspended section, at 900 lb. per linear foot, demanded strength. The fact that the duct housed vital cable circuits supplying an important Milwaukee load center and was only about 30 ft. from a main railroad line further complicated the situation.

Details of the suspension used is shown in the accompanying illustration. Seven 7-in. 110-lb. street railroad rails 60 ft. long were nested and extended across the excavation to form the main support beam, from which the duct was suspended at 4-ft. intervals by $\frac{5}{8}$-in. rods threaded at their upper ends to permit load adjustment. These rods ran from 3x6-in. timbers across the top of the main support beam to 4x6-in. so-called "needle beams" under the duct.

To make the support more rigid against shock blows four $\frac{9}{16}$-in. plow steel cables, two on each side of the duct, were run from the ends of the main support beam under the center four needle beams, to form a truss. Turnbuckles in the cable permitted tension to be adjusted as desired.



**COMBINES** beam and truss to support concrete duct section during excavation for sewer chamber




**STEPS** in constructing chamber under vital cable line—(a) Duct suspended from beam and truss, (b) weight transferred to pipe columns, (c) columns cut off and duct supported by sewer chamber roof

The main support beam was not more than 4 ft. above the duct at any point nor was clearance more than 6 in. on either side or below the duct. Thus the support for the duct line left the maximum space free for manipulation of the clam shovel used in excavation.

Extreme care was used in taking up the load of the duct and in releasing it when the project was completed. Deflection of the beam under load was calculated at points along its length and the suspension bolts were taken up in accordance (more at the center than at the end) so that the duct was not allowed to flex and develop cracks.

When excavation around the duct was completed and the floor of the sewer chamber poured the load was transferred from the suspension described to temporary columns made

from 5-in. diameter steel trolley poles spaced at 4-ft. intervals under the duct. The main support beam was then removed as its weight (7½ tons) was in constant danger of caving in the sides of the excavation at the support points.

Roof of the sewer chamber was poured around the duct and its pipe column supports, which were simply cut off flush with the concrete with a torch when the concrete had cured, leaving a short length of the pipe in the roof of the chamber, as shown in the accompanying sketches.

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## 5,000-Ft. Span for Canyon Crossing

T. C. SMITH* and R. W. RETHERFORD†

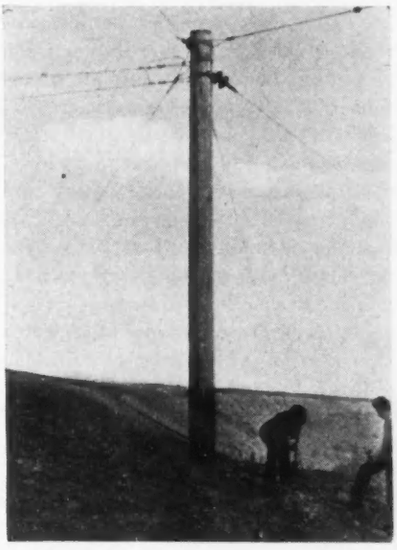
Clearwater Valley Light & Power Association, Inc., Portland, Ore.

Near Craigmont, Idaho, across Big Canyon, on the edge of the Camas Prairie, the Clearwater Valley Light & Power Association has constructed a 5,025-ft. span of 7.2-kv. distribution line. Two other spans, one 3,060 ft. and the other 3,170 ft., had previously been constructed and has been in operation nearly two years.

* Chief Engineer. † Resident Engineer.

**AERIAL SURVEY MAP on which the power line is spotted in white ink**

It shows the location of the 5,025-ft. span constructed by the Clearwater Valley Light & Power Association, Inc., across Big Canyon Creek, east of Reubens, Idaho.



**COMPLETED pole assembly showing guying arrangements of one pole**

Both were canyon crossings using wooden poles for dead-end structures and a cable of three No. 6 extra-high-strength Copperweld strand, ultimate strength better than four tons, for conductor. An inspection of the route showed it to be the only feasible one and also that a long span crossing was far more desirable than a hard-to-build, difficult-to-maintain line, down into the canyon and out again.

The requirements necessary for the span were: Span length, 5,025 ft.; minimum clearance above high water level, 20 ft.; elevation of supports above high water level, 1,175 and 1,200 ft.; assumed maximum loading conditions ¼ in. ice, 8 lb. wind at 15 deg; maximum tension in conductor limited to 50 per cent of rated breaking strength under assumed maximum loading; voltage, 7,200; conductivity of cable, No. 6 copper equivalent. The conductor used was seven No. 9 extra-high-strength Copperweld strands, rated breaking strength 11,280 lb., and initial sag and tension of span 500 ft. at about 2,000 lb. The insulator assembly consisted of Pinco, clevis type, with 4-bolt strain clamp. The pole assembly was three 30- and 35-ft. Western red cedar, each guyed four ways with 4-ft.x12-in. creosoted logs buried in rock, providing the necessary anchoring.

In the span design there arose the question of vibration. On the two other spans no vibration has been noted and no damping of any kind has been employed. However, should any vibration be noted or not noted, as the case may be, the conductor will be tightened every few years (the time depending on conditions noted) sufficiently to remove the weakened spot from the span and expose a new section as the "node" for the future vibration. This would require a shift of about 6 in. at each strain clamp or a total of one foot. The conductor was sagged to a depth that will allow approximately 25 ft. of wire to be taken out before the design sag is reached.

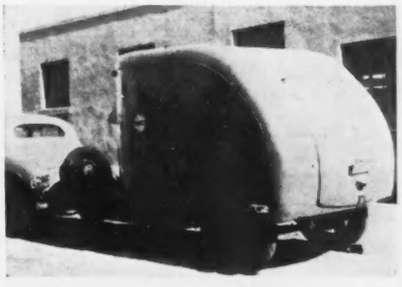
Complete construction was done in about two days by the O. A. Carlson Electric Company of Seattle. Total cost was $1,420.79. This cost is less than that required to build the line down and out of the canyon and is further considered a good insurance against forest fires.

•

## Drum Bins in Trailer Carry 160 Meters

This compact turtleback trailer is used by the Southwestern Light & Power Company, Lawton, Okla., for transporting and changing out meters. The trailer, housing 160 meters in individual bins, also has space for equipment and test apparatus in the turtleback.

Meter bins are part of a drum turntable 5 ft. 6 in. in diameter and 42 in. high, which is divided into five tiers with sixteen compartments to a tier. Each compartment contains two meters. Access to the turntable, which is mounted on a full floating vertical axle, is from the curb side to protect metermen from traffic.



**USED in meter change-out program, this trailer carries 160 meters in compartments of revolving drum**

A linkage attached to the door clamps a wide sheet-iron band around the bin drum when the trailer door is closed. This serves the double purpose of closing all compartments and

clamping the drum in place to keep it from turning at all times except when trailer is stationary and the door open.

Designed for use with a light pick-up truck, the trailer can, as shown, be used with a coupe or other passenger car. It is 6 ft. wide, 10 ft. long and weighs about 1,000 lb. It is used for transporting single-phase units only.

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## Control Panel Lifted When Floods Threaten

By EARL B. ANKENMAN
Westinghouse Electric & Manufacturing Company, Boston, Mass.

During the 1938 hurricane and flood the control room of a substation in utility service was so badly inundated that an important control board was forced out of commission from mud and water completely covering the panels, meters, switches and pilot lights. The circuits supervised were for the most part above flood level and were ready for operation long before the control board was dug from the debris. Thus a relatively minor item in the system delayed the restoration of service.

Rehabilitation of the old board was possible, of course, but did not give any assurance that the system would not be out of commission again in the event of another flood. Replacement of the old board with another of the conventional type was not the answer. The control room could have been raised above any probable flood level, but that entailed a large outlay and much operating inconvenience. The problem was solved by replacing the old board with a new board entirely free from a solid foundation so that it could be raised above the water level if necessary. Seven circuits are controlled, including a transformer bank. There are 27 meters, 26 control and meter switches and 26 control lights arranged on a panel only 48 in. wide x 62 in. high. All compensators, buses and terminal blocks as well as test switches were mounted on brackets on the rear of the panel, the brackets being mounted at right angles so that all instruments and switch terminals are accessible.

The board was built with three hand clamps at each side and two lifting rings on the top. Normally the board will be clamped to angles set in the control room floor. All the leads coming to the board are suspended from the high ceiling and anchored to the wiring trough at the top of the board. With this arrangement, when floods threaten, the board is unclamped and a station crane hooked into the lifting rings. The board is then raised 9 ft. and the incoming wires simply loop behind it. No wires are disconnected, and the flood danger passes, the board can be lowered and immediately restored to normal service.

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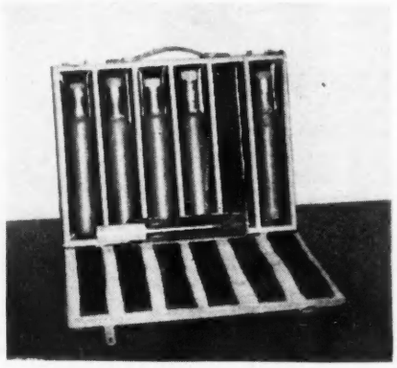
## Temporary Seal for Paper-Insulated Cable

A temporary dead-end for 15,000-volt, paper-insulated, single-conductor cable, 250,000 circ.mil and under, is



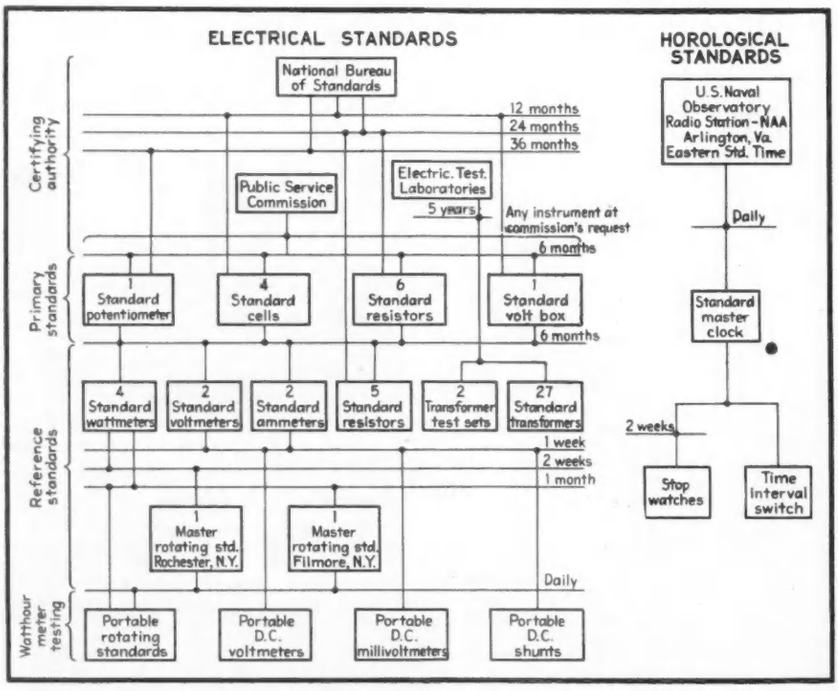
**DEAD-END DEVICE for lead-sheath, paper-insulated cable speeds restoration of emergency service, excludes moisture, protects cable end**

used by the Dallas Power & Light Company as a temporary seal over exposed cable ends during construction, or in emergency situations, so that the cable can be safely energized and restored to service pending a permanent repair. The seal, illustrated, acts to exclude moisture, protects exposed cable ends and prevents accidental contact with the energized conductors.

To install the dead-end the lead sheath is removed from the cable, leaving about 8 in. of factory insulation exposed. The cable is then inserted into the device so that the lead sheath comes just inside the end of the brass ferrule, which is then sweated temporarily to the cable sheath. In cases where the dead-end is to be left in service for more than a few days the device is filled with petrolatum before the cable is inserted.

When not in use the dead-ends are kept in specially built cases, one of which is shown. Corks are inserted in the brass ferrule to exclude moisture. The Dallas company has a stock of 25 of these units.

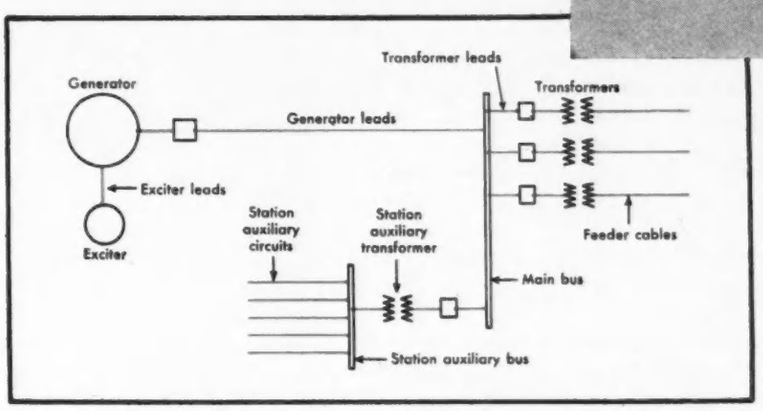
## Schedule of Meter Standardizations




**The above chart shows the program of scheduled calibrations as followed in the standardizing laboratory of the Rochester Gas & Electric Corporation. Certificates, tests and test results for all the operations shown on the chart are filed for permanent reference**

# No. 1799 VARNISHED CAMBRIC

# Has the LONG LIFE Needed for STATION CABLE




**For runs from generator, to buses, switches, feeders, and station auxiliaries—at all voltages**

THOSE properties of an insulated cable that make it last are inherent in varnished-cambric cable. This is borne out by performance records. G.E. originated this type of cable and first manufactured it about 1900; since then thousands of installations of VC station cable have been made, and their records are evidence of its long life.

### Properties Are Inherent

The reasons: With cloth tapes wrapped around the conductor, the insulation cannot get out of place. The insulation is uniform throughout the length of the cable, whether that be 10 feet or 10 miles. The insulation is elastic, and the cable is flexible—easy to handle and to install. In soldering, the insulation is not easily injured. Jointing and terminating are simple operations.

### No. 1799 Has Even More

In No. 1799 varnished cambric, all these properties are retained and another added: it is more heat-resisting. The cable can be operated at approximately 10 to 15 deg C higher than could the former G-E design. This means, of course, savings in copper, particularly advantageous for station wiring where heavy currents must be carried at low voltages.

### Special Design, If Needed

No. 1799 VC cable is available in all standard types: braided, leaded, and armored; also for transformer, apparatus, and switchboard leads. Often the requirements of a station cable call for a slightly off-standard type, and our engineers have designed hundreds of these. If in doubt as to which type is best for a particular station job, call a G-E cable specialist. General Electric, Schenectady, N. Y.

**GENERAL ELECTRIC**

500-10

# INDUSTRIAL ENGINEERING

## Multiple Feed Control Box in Channel Column

To maintain maximum aisle space in production departments at the plant of the Heald Machine Company, Worcester, Mass., a flush type terminal box for column installation is utilized, providing (in the case illustrated) for eight three-phase, 550-volt power circuits. This machine tool builder worked with the engineers of the Trumbull Electric Manufacturing Company to realize this method of space economy, and the typical box shown is only 66 in. high x 6½ in. wide x ⅞ in. deep.

**EIGHT power circuits can be fed from flush box on shop column**

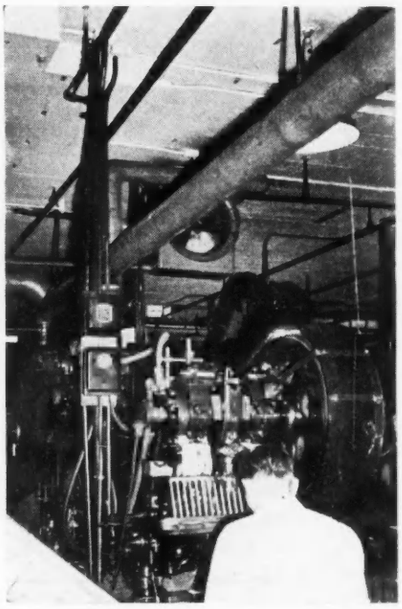
At the top a 70-amp. main switch is installed to control the group of circuits leading from the box, and the inside is lined with asbestos behind and beside the terminal block units from which leads are run to the motor and control equipment serving adjacent tools. The terminal blocks are of ⅛ x 1 x 10-in. copper strap and all wiring is straightforward from the 1½-in. supply conduit and switch at the top of the box through the terminal stud strap connections and thence to the several motors.

In the case illustrated only one motor connection had been installed when the photograph was taken, but knockouts in the bottom of the box enable take-offs to be quickly made. In normal service, the box, which fits easily between the column flanges, is covered with a metal lid shown at the right, the only openings being for screws for attachment to lugs within the box, and one for the handle of the main switch.

•

## Mount Machine Control on Pipe Columns

In both the old and new sections of the Minneapolis-Honeywell Regulator Company plant in Minneapolis, Minn., safety switches and motor starters for production machines, particularly punch presses and screw machines, are mounted on a 1¼-in. pipe column beside the machine. This has several advantages. In the case of heavy punch presses it frees electrical contacts from possible damage due to vibration and provides a mounting place for controls for a type of machine on which control mounting is notoriously difficult. The column is a convenient support for conduit, as well as air and oil pipe lines to the machines, contributing to neatness. Ease with which the column can be detached from ceiling and floor makes relocation of machines simpler. The machine and its column, complete with controls and attached conduit, can be moved as a unit.



**SAFETY SWITCH and motor starter on pipe column beside machine reduce contact chatter and simplify relocation of machine**

A simple "trick" makes installation and removal of the columns quite easy. Each column is attached to the floor and ceiling by pipe flanges customarily threaded to the pipe. For convenience in this case the threads on the upper flange are reamed out so that it can slide up and down the column. With this arrangement holes may be drilled in the floor for the lower flange, the column erected and "plumbed" and by sliding the upper flange into place the ceiling holes accurately located. With this done the upper flange may be slipped down and holes drilled with the pipe in

# WHY UNIFORM CHARACTERISTICS ON HEAVY LOADS?

A WATTHOUR METER with minimum inherent errors on heavy loads is desirable because such a meter requires little compensation to achieve high accuracy of registration. And when the needed compensation is small, the variations in performance characteristics between individual meters become negligible.

Since the chief cause of inherent error in registration of heavy loads is the damping torque resulting from the current-coil flux—and this error is directly proportional to the rotor speed—it stands to reason that the features of low nominal speed and low useful current flux contribute to greater uniformity of characteristics.

And that is why these features—which have characterized General Electric watthour meters since 1926—still are the basis of the uniformly accurate I-30 line.

**GENERAL ELECTRIC, SCHENECTADY, N. Y.**

**GENERAL ELECTRIC**

place. This avoids the obviously difficult job of spotting holes for floor and ceiling flange fastenings before the pipe is erected. There is less chance of getting the column up "out of plumb."

•

## Flexible Mounting Aids Production

Recent motor drives applied to former group-driven machine tools transferred from an old to a new industrial plant in New England illustrate the advantages of flexible mounting in a drill press drive and an engine lathe drive. The drill is equipped with a 2-hp., 550-volt, three-phase induction motor mounted on an adjustable base plate with provision for lateral and vertical shifts in position on substantially a micrometer basis of movement, combined with a short belt drive to the cone pulley head, which is belted flexibly by vertical connection to the main shaft of the tool.

By supporting the motor a few inches above the floor and at the rear of the tool shop operations are conveniently handled, and a short, flexible conduit connection from the starting box to the motor and the starting button on the main frame of the drill saved material. The advantages over the former rigid type of support are marked, both from shop maintenance and electrical inspection viewpoints.

In the engine lathe drive a bracket supported frame with provision for changing the position of the motor through a convenient arc above the tool keeps the drive clear from shop activities and contributes to suitable belt tension. Wiring is in flexible conduit inside the over-all projection of the tool and drive, leaving adjacent shop space free for other operations.

•

## Checks Motor Belts With Static Voltmeter

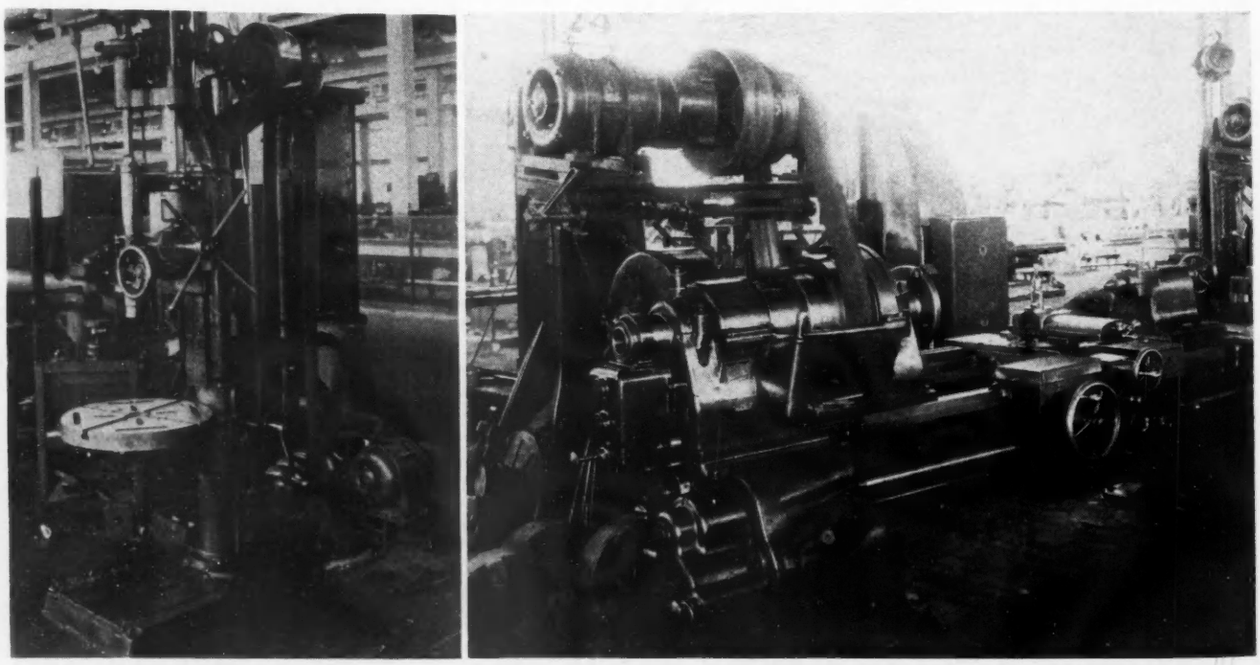
Static electricity can be a particularly troublesome hazard in a powder plant, so a well-known chemical company recently conducted tests with a General Electric electrostatic voltmeter to find out the extent of the static electricity generated on its conveyor belts, motor drive belts, rubber-tired trucks and from actual walking on floors.

In checking the V-belt of a 25-hp. motor the 20,000-volt static voltmeter went off-scale — observation of the discharge spark indicated the presence of approximately 37,000 volts on the V-belt. Another test indicated that 6,000 volts was generated simply by walking across the carpet of an office.

These preliminary tests led to more extensive checks in all of the chemical company's plants. As a result, belt dressings were investigated to find one of a conducting nature that would permit a continuous discharge of accumulated static electricity. All trucks were equipped with grounding chains, various types of flooring were investigated and many other changes were made to minimize the hazards of explosion from static electricity.

**ELECTROSTATIC VOLTMETER reveals 37,000 volts on 25-hp. motor V-belt in powder plant**

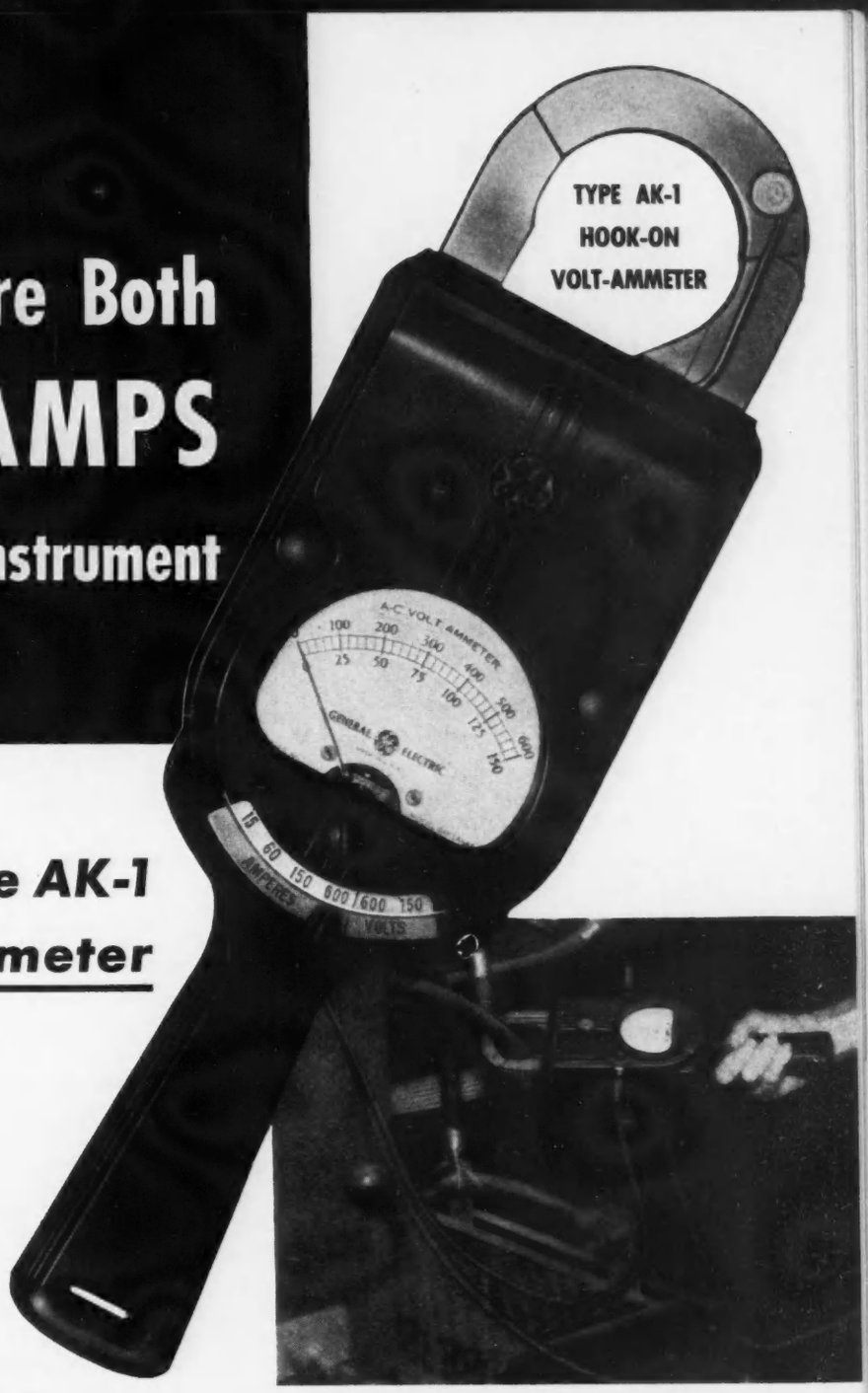
The electrostatic voltmeter used in detecting the static is a portable instrument designed for both a.c. and d.c. measurements of voltage on systems where one line is grounded. Operation is a matter of grounding the case, energizing the light source and making the high-voltage connection.



**LOW BRACKETING of drill press motor improves accessibility of drive (left). Adjustable mounting of lathe motor utilizes space of no manufacturing importance (right)**

# NOW

## You Can Measure Both VOLTS and AMPS with a "Hook-on" Instrument




## *That's Why We Call the AK-1 A Hook-on Volt-ammeter*

IT'S no trick at all to measure both alternating current and voltage with it. All you do is hook the instrument around the line and read amperes. Then connect the leads to the binding posts and read volts.

### No Additional Equipment Needed

You don't need a separate transformer, voltmeter, or any other additional equipment. And you don't need to cut conductors or shut down equipment to make your measurements.

### One Setup to Measure Current and Voltage

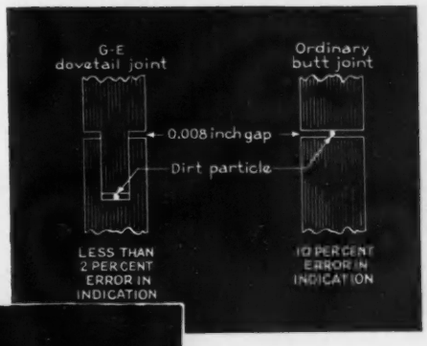
After measuring voltage, leaving the leads connected does not affect hook-on current readings. Just flick the selector switch to either "Amperes" or "Volts" according to the measurement you want.

**Our bulletin GEA-2950 describes the AK-1 in detail, and illustrates how easy it is to use. Order a copy from your nearest G-E Office, or write General Electric, Schenectady, N. Y.**



### For Emergency and Maintenance Testing

**This instrument is particularly handy for quick, accurate measurements when you have trouble with electric equipment and need the answer to circuit conditions in a hurry. Also, you will find it very useful for checking the loading of motors, and for other routine maintenance measurements.**




### Special Dovetail Joint Assures Consistently Accurate Readings

**The hook that closes around the conductor has a dovetail joint which minimizes errors caused by unnoticed dirt lodging between the jaws of the instrument. Particles of dirt which would cause large errors in the ordinary butt joint have almost negligible effect on the readings obtained with the AK-1.**

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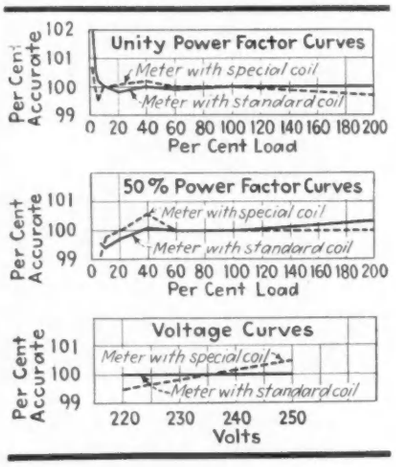
# NEW ENGINEERING IDEAS

## Raise 120-Volt Meter Ratings to 240

By L. R. SPAULDING
Northwestern Electric Company, Portland, Ore.

Northwestern Electric Company has for some time been converting a surplus of two-wire, 5-amp., General Electric I-14 meters into three-wire, 25-amp. sequence meters. The process has been covered fully in previous articles. Principal item of expense has been the purchase of




**CALIBRATION CURVES for potential coil before and after conversion**

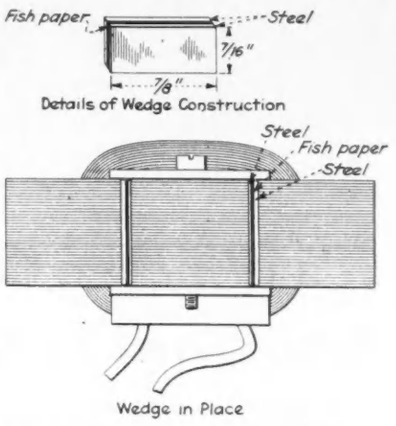
new 240-volt potential coils and iron at about $2.60 per meter.

We recently have developed a means of using the old 120-volt potential coils for 240-volt service. This 120-volt coil formerly was discarded when converting.

The two air gaps in the core are closed uniformly with laminations of iron which have permeability curves such as to give reasonably accurate meter performance under all operating conditions. The exact dimensions of the non-magnetic gap allowed to remain and of the iron used have been chosen to give the accuracies shown. The error in the voltage curve is not considered serious in view of the rather close limits of voltage variations allowed on present systems.

Putting a standard 120-volt coil across 240 volts in a three-wire meter not only would overheat the coil but also would cause an excessive current to be drawn. This would be costly. Also, the disk torque would be doubled, giving erroneous readings. Partially closing the air gap in the core of a 120-volt coil decreases the reluctance of the core, thus permitting more flux to flow in the magnetic circuit. This tends to increase the inductive reactance of the coil so that, when it is placed across a higher voltage, it still will pass its normal amount of current. Also, because the air gap has been lessened, the amount of leakage flux applying torque to the disk has been lessened and the disk makes normal revolutions. Reduction of the air gap is accomplished by means of a wedge.

Since both the 120 and the 240-volt coils normally are tested at the same voltage to ground (1,000 volts, it will be seen that the converted 120-volt coil will operate safely on 240 volts.




**INSERTION of this steel-and-paper wedge reduces the magnetic reluctance of the core**

Accuracy curves at varying temperatures for these special, rebuilt meters are not complete, but tests made at two points (70 and 160 deg. F.) indicate that accuracies are well within practical limits.

Comparative data are shown in Table I. All tests are made at full rated load. Temperature-correction shunts were placed in all meter magnets. Additional data on these coils are given in Table II.

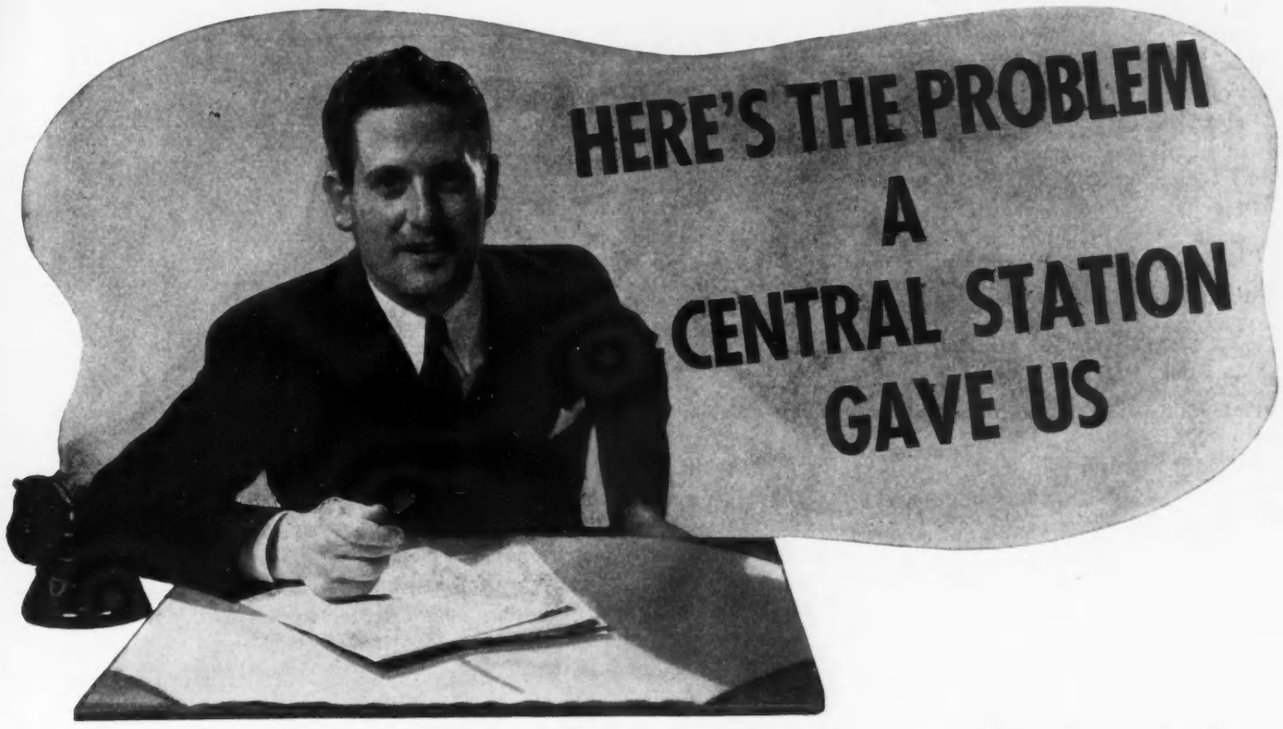
The I-14 potential coil seems to be the one most suited to this type of conversion because its large iron core permits doubling the flux without approaching saturation. There are,

**Table I**

| Temperature Deg. F. | I-14 (Special) 100% P.F. | I-14 (Special) 50% P.F. | I-14 (Standard) 100% | I-14 (Standard) 50% | C.S. (Standard) 100% | C.S. (Standard) 50% |
|---|---|---|---|---|---|---|
| 70 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100.7 | 99.6 | 100.5 | 96.5 | 100.2 | 97.2 |

**Table II**

| | Milliamps. Passed | Watts | Temperature Deg. C. | Magnetic Lines Per Sq. In. of Core |
|---|---|---|---|---|
| Std. 240 v. coil, G.E. I-14 on 240 v..... | 55 | 1.7 | 24 | |
| Special 240 v. coil on 240 v..... | 110 | 2.7 | 29.5 | Approx. 2 x std. coil |
| Std. 120 v. coil on 120 v..... | 110 | 1.7 | 24 | |



# HERE'S THE PROBLEM A CENTRAL STATION GAVE US

"We need a station control cable which will allow high current densities during peak load periods. Then, it must resist extreme ambient temperatures successfully. In addition, it must be flameproof and physically tough, able to stand a lot of severe treatment. We don't want to use rigid conduit, so it must have an outside cover that will take the place of conduit and still give the cable the same protection."

That was a pretty tough nut to crack, but G-E Deltabeston engineers went to work, and the cable you see here was able to meet all the requirements and is giving satisfactory service right now.

Deltabeston Power Cable, Deltabeston Resistor Cable, Deltabeston Switchboard Wire will all give you outstanding service. But—if you need an an "extra special" cable, custom-built for a particular installation—let us help you. Let Deltabeston engineers give you the benefit of their years of experience.

We'll be more than glad to serve you whenever you have a problem similar to the one above. But in the meantime, get a copy of the complete General Electric Deltabeston Catalog by writing to Section Y-0131, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

**GENERAL ELECTRIC**

however, other meter potential coils which can be so changed with slight variations from the method described.

Meters so converted are now in use in a number of districts in Oregon and Washington. The shunt can be installed in about the same time ordinarily spent in changing potential leads from the old 120- to the new 240-volt coil. Therefore, no additional labor need be charged to the meter if the work is done when changing to sequence type. We have dies for the job which insure uniformity and speed and which reduce total cost to a fraction of the cost of a new coil. Steps are now being taken to secure a patent on this device.

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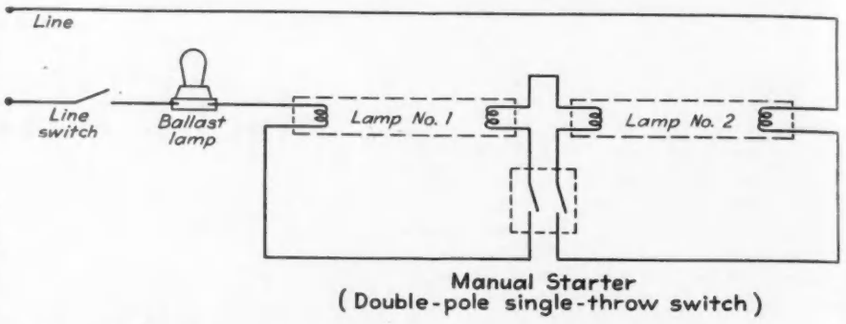
## New Method of Fluorescent Operation

A new method of operating fluorescent lamps has been developed by the Hygrade Sylvania Corp., Salem, Mass., in connection with the marketing of a 14-watt, 15-in. lamp (type T12) designed among other uses for floor lamps employing in the past three candle type units and diffusing cups and a 100-200-300-watt lamp in a 10-in. bowl. The standard 15-watt, 18-in. fluorescent lamp has been used to some extent in this application, but has been found slightly too long for a satisfactory design, according to the manufacturers. Another objection has been that although two lamps have generally been employed, the control units have not been of the power-factor corrected type.

The use of two lamps in series with a resistance ballast on alternating current is the heart of the new method and provides a power factor exceeding 90 per cent. It also insures quiet operation with no ballast hum and reduces the initial cost of ballast equipment. While the stroboscopic effect is not eliminated, it is seldom objectionable in the application above noted, especially where used in conjunction with incandescent lamps. Other applications, such as bathroom mirror lighting and local lighting units for various purposes, are expected to develop.

It is anticipated that in most applications the lamps will be within easy reach, and instead of an automatic starter it is practicable to use a simple type of manual starter near the lamps. As with other fluorescents, the purpose is to connect the electrodes in series for a brief preheating period and then open the circuit in order that the arc may be established in the lamps. It is possible that this starter and the line switch may be incorporated later in a single switch of the "push-in" type designed to make connections with a single push and open the cathode circuit, but maintain the line connection when the bottom of the stroke is reached. The next depression of the switch would open the line circuit and thus turn out the lamp.




**ESSENTIAL** circuit details for operating 14-watt fluorescents, two in series

•

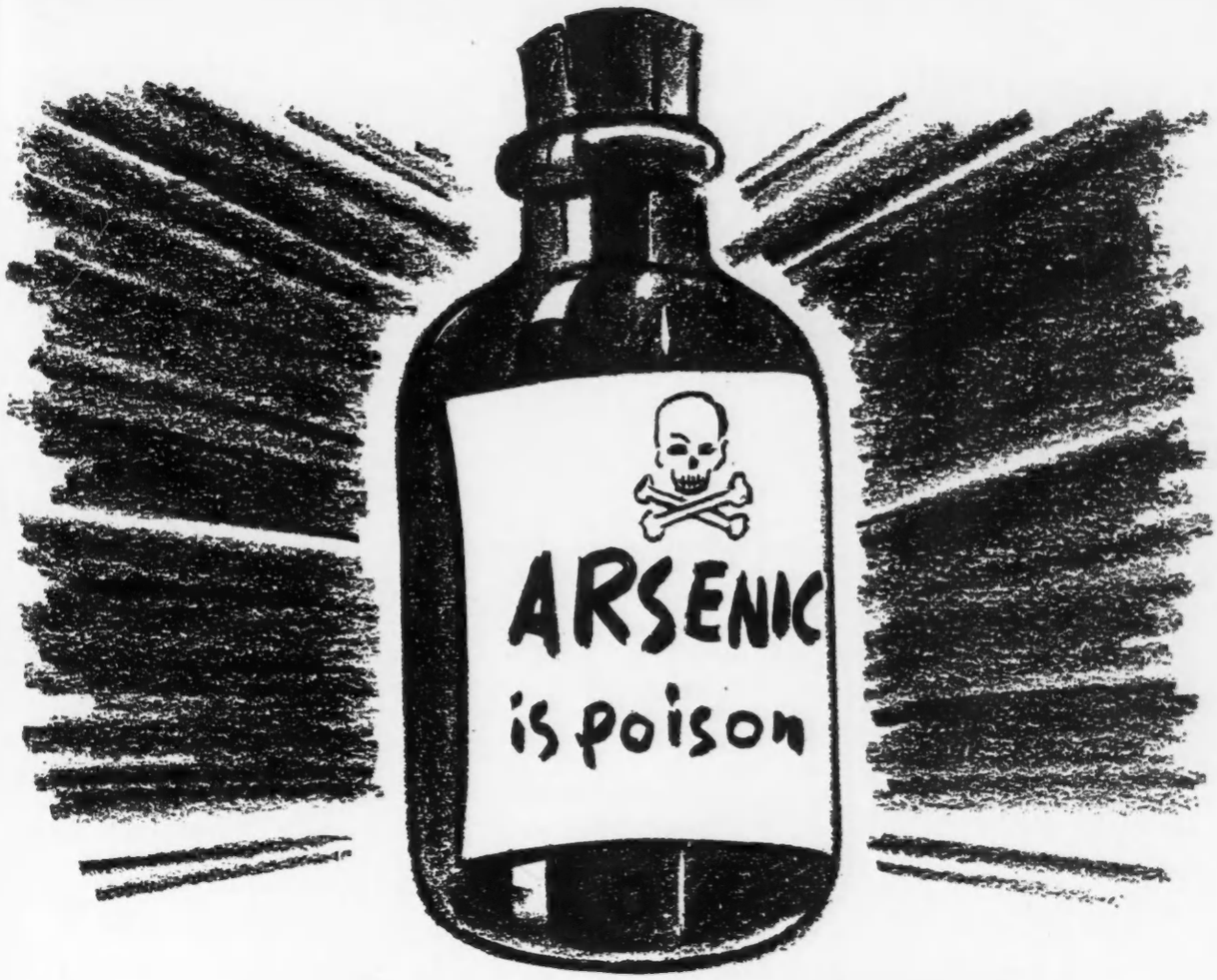
## "Bake" Straightness into Turbine Shafts

One of the controllable ways to reduce turbine vibration is to make sure that turbine rotors retain perfect straightness at 3,600 r.p.m. operating speeds and 950 deg. F. temperatures. S. Homer Weaver, General Electric engineer, recently received a Charles A. Coffin award from his company for his method of "baking" permanent straightness into steam turbine shafts and rotors.

In his process the machined-straight shaft or rotor is suspended in a standard lathe bed. The electric oven, sectionalized for different length requirements, is closed about it and controlled heat is applied through strip heaters on the wall. The rotor is turned at 2 r.p.m. and thermocouples riding on it give temperature readings on a calibrated millivoltmeter. As the oven heat is raised the rotor loses its straightness.

Sliding rods passed through the wall (like the one Mr. Weaver holds) ride against the turning rotor and indicate the increasing shaft distortions as the temperature rises. Then, at a certain critical temperature—from 750 deg. F. for carbon steel to 900 deg. F. for alloy steels—a straightness is restored which is not affected by subsequent temperature or temperature changes. No additional lathe or milling operation is necessary; the process is purely a temperature "cure."

**HEAT-TREATING PROCESS** assures true-running, high-speed turbine shafts




# . . . to dezincification

The use of arsenic as an inhibitor of dezincification antedates the use of other practical inhibitors. Field studies and practical experiments over many years confirm the advantages of arsenic as the best available inhibitor for condenser tube dezincification.

In examining many instances of condenser tube failure during the past three years, the Revere Research Laboratories found the following:

| NO. OF TUBES | FAILURE THROUGH DEZINCIFICATION |
|---|---|
| 36 tubes without commercial amounts of arsenic | 36 |
| 10 tubes with .02% to .06% arsenic | *none* |

In addition, arsenic does *not* have undesirable effects on Admiralty metal. There is no tendency towards season-cracking or stressless intergranular corrosion.

Consider the advantage of selecting Revere Arsenical Admiralty Tubes for maximum over-all economy. Replacement costs, shut-down costs, and damage costs due to tube failure may be cut considerably by specifying Revere Arsenical Admiralty Tubes in your installations.

• • •

Since each condenser tube installation presents an individual problem, we invite you to use the Revere Technical Advisory Service in helping you select the best tube for maximum service and economy. This service is free for the asking.

## Revere Copper and Brass Incorporated

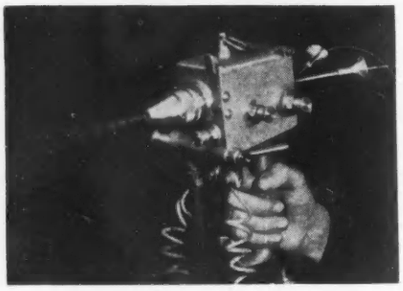
*Executive Offices:* 230 Park Avenue, New York, New York

*Sales Offices and Distributors in most of America's major cities.* MILLS: BALTIMORE, MD. • TAUNTON, MASS. • ROME, N.Y. • NEW BEDFORD, MASS. • DETROIT, MICH. • CHICAGO, ILL.

# Electric Pistol for Spraying Metals

By Dr. M. U. SCHOOP
Zurich, Switzerland

Essentially this new electric pistol consists of two current-carrying wires short circuited, the melting drop that forms being finely divided and sprayed by means of compressed air. At the point of break a small arc is formed which provides for the further melting of the wires which are shifted by means of an air turbine. It is an interesting fact to note that the small



**ELECTRIC PISTOL to be used for fusing metals**

arc continues to exist although a stream of compressed air of 8 to 10 atmospheres over pressure is directed on it.

For the spraying of one square meter of sheet iron with zinc two minutes is necessary with a current consumption of 180 amp. × 50 volts d.c. or a.c. The number of short circuits and arcs which occur in the unit of time can be ascertained by passing a black strip of paper rapidly through the spraying cone, and then the sprayed metal dissolves into uniform "spray spots" that follow one another in rapid succession. The proceeding can better be observed in a rotating mirror.

The temperature of the arc is extremely high (4,000 deg. C and over); it is, therefore, understandable that the metal particles of the spraying cone have a considerably higher temperature than in the case of the standard pistols with compressed gas. If, for example, a glass plate is metallized with aluminum the aluminum particles on impact are so hot that they melt into the glass surface and a separation of the aluminum coating is impossible under any circumstances.

Because of the extremely powerful emission of ultra-violet rays one must work with dark goggles.

This electric pistol may be used to spray on such metals as tungsten, molybdenum and chromium, which are difficult metals to fuse.

•

# Ground Protection on Electric Shovels

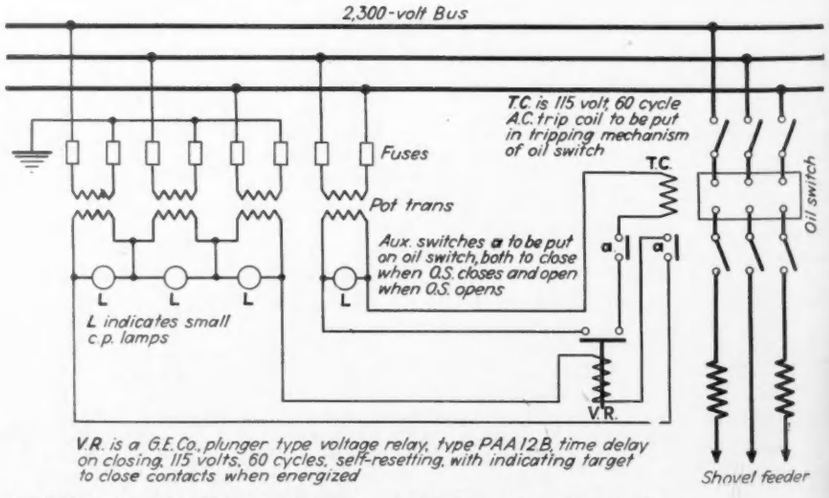
By GLEN APPELMAN
Grounding Engineer
Pennsylvania Power & Light Company, Allentown

As a means of necessary protection against grounds on electrically operated shovels the Pennsylvania Power & Light Company of Allentown has designed a ground fault tripping device for a cement company on a 2,300-volt system. Generally a ground fault on one phase only of a three-phase 2,300-volt circuit operated normally ungrounded will pass practically no current; it is limited to electrostatic induction and leakage over insulation. But if a second ground should meanwhile occur elsewhere on the system undesirable potentials to ground might exist and constitute hazards.

Essentially the protective system consists of three 2,300/115-volt potential transformers with primaries wye-connected and neutral point grounded. Secondaries are delta-connected, with one corner of delta run through a voltage relay and auxiliary "a" switch on the oil switch, which opens when the oil switch opens. A fourth potential transformer is used to supply tripping current to an a.c. 115-volt trip coil on the oil switch. An auxiliary "a" switch on the oil switch breaks the tripping current and prevents damage to the relay contacts.

The lamp of small candle-power connected across the secondary of the transformer used for tripping serves as a continual check of supervision on the tripping supply. The three small candle-power lamps across the secondaries of the grounded potential transformers are also to indicate that all three are working correctly and also to indicate when a ground fault exists. The lamp across the phase on which the fault occurs will burn dim or go out entirely and the other two lamps will burn up to full brilliancy. When this occurs the voltage relay "v.r." will have voltage impressed on its operating coil and will close its contacts When no ground fault exists there is no voltage on the coil of this relay. Upon closing of the relay contacts the shovel feeder oil switch opens and the three lamps will burn at the same brilliancy if the fault was on the shovel feeder. If it is on some other part of the 2,300-volt system one lamp will still burn dim even with the shovel feeder open. This must be located and cleared before the shovel feeder can be kept closed.

Ground faults occurring on the shovel and at some other part of the circuit produce the same result; *i.e.*, open the shovel oil switch. In such a case there might be a momentary rise of voltage from the shovel to ground. However, such faults at different points on the 2,300-volt circuits are rare. One fault at a time is cleared with no hazard to workmen around the shovel, while the double fault is cleared as soon as the relay and oil switch can operate.


2,300-volt Bus
T.C. is 115 volt 60 cycle A.C. trip coil to be put in tripping mechanism of oil switch
Fuses
T.C.
Pot trans
Oil switch
Aux. switches a to be put on oil switch, both to close when O.S. closes and open when O.S. opens
a
a
L
L
L
L
L indicates small c.p. lamps
V.R.
V.R. is a G.E.Co. plunger type voltage relay, type PAA 12B, time delay on closing, 115 volts, 60 cycles, self-resetting, with indicating target to close contacts when energized
Shovel feeder

**GROUND FAULT TRIPPING DEVICE for 2,300-volt system. A ground anywhere on the 2,300-volt system will trip shovel feeder**

Save
WHILE SERVING
. . . save with a Hoosier-built transmission line while serving power to industries and communities everywhere. Organization, equipment, tools, competent supervision and personnel are made available to you at a saving in time and dollars when you choose Hoosier.

# HOOSIER ENGINEERING COMPANY

CHICAGO — 46 SO. FIFTH ST., COLUMBUS, OHIO — NEW YORK

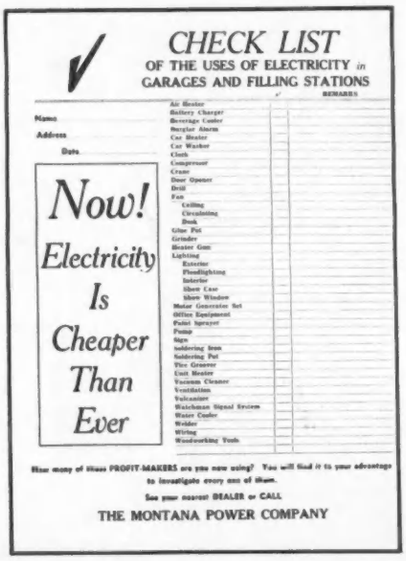
Canadian Hoosier Engineering Company, Ltd., Montreal, Canada.

ERECTORS OF TRANSMISSION LINES

# LOAD BUILDING

## Check List Has Personal Touch

A note of personal service has been injected into the check-list idea by Montana Power Company to produce


CHECK LIST
OF THE USES OF ELECTRICITY in GARAGES AND FILLING STATIONS

Name
Address
Date

Now! Electricity Is Cheaper Than Ever

REMARKS

Air Heater
Battery Charger
Beverage Cooler
Burglar Alarm
Car Heater
Car Washer
Cloth
Compressor
Crane
Door Opener
Drill
Fan
Ceiling
Circulating
Desk
Glue Pot
Grinder
Heater Gun
Lighting
Exterior
Floodlighting
Interior
Show Case
Show Window
Motor Generator Set
Office Equipment
Paint Sprayer
Pump
Sign
Soldering Iron
Soldering Pot
Tire Groover
Unit Heater
Vacuum Cleaner
Ventilation
Vulcanizer
Watchman Signal System
Water Cooler
Welder
Wiring
Woodworking Tools

How many of these PROFIT-MAKERS are you now using? You will find it to your advantage to investigate every one of them.

See your nearest DEALER or CALL

THE MONTANA POWER COMPANY

**MONTANA POWER uses a series of check lists, each directed at a particular type of commercial customer. This one, for example, is distributed to garages. Other forms are prepared for dry goods stores, grocery stores and similar businesses**

an effective aid to selling commercial load. Lists are worked up and printed for different types of commercial customers. For instance, one reads: "Check list of the uses of electricity in dry goods stores." Another: ". . . in garages and filling stations."

Salesmen make out the list, retain a carbon and leave the original with the customer. The latter thus has a reminder, written in terms of his own business, of various ways in which electricity may help him operate more effectively.

The sheets are worked up in simple form, kept free of extraneous type matter. The advantage of investigating each use as a possible profit maker is mentioned and the customer is directed to see his nearest dealer or call the power company.

•

## Electricity Helps Tobacco Stripping

By J. H. FIESTER

Kentucky Utilities Company, Lexington

Because of the short stripping season Penn Brothers, Lexington, Ky., one of the largest burley tobacco growers in the world, growing on an average of 225 acres per year, was very anxious to work out a method to increase stripping hours and handle tobacco during any kind of weather.

Our commercial service department designed a lighting system consisting of 48 300-watt Holophane units with a color-correcting lens producing approximate daylight. These units were spaced 8 ft. apart and 7 ft. from the working plane, giving 20 ft.-candles on the working surface. This installation enables the customer to strip and grade his tobacco both day and night and proved to be very satisfactory. While we realize this is not the only method for properly lighting a tobacco barn, we feel that it is a very satisfactory method, and this is evident by the fact that the tobacco that was graded and stripped under this lighting system brought the highest return on the local market.

The barn is also winter air conditioned. It is divided into three sections—one section is where the tobacco is brought into handling case by heating and humidifying; section two is a stripping room, where enough heat and humidity are added to keep

**TOBACCO STRIPPING not limited by weather and daylight in this barn**

# A LESSON IN LOAD BUILDING

....BUT BAKERY SHOPS ARE A CINCH FOR THIS NEW EDISON-HOTPOINT ELECTRIC BAKE OVEN... IT'S 25% FASTER, AND 35% MORE EFFICIENT!
YEH? HOW MUCH... AND WHAT KIND OF A LOAD WILL IT BUILD?
JOLT & VOLT POWER CO.
I'M THE BOSS
....LOAD? MAN, BAKERY SHOPS ARE RIGHT ON OUR MAIN STREET LINES... AND BAKERY LOAD MEANS STEADY REVENUE. COME ON... I'LL SHOW YOU!
H-M-M-M, MEBBE SO, BUT HOW DO I KNOW WHAT OVEN IS THE RIGHT ONE?
MY BAKE OVEN MUST BE FAST, ECONOMICAL, DEPENDABLE, CLEAN AND SAFE. THAT'S WHY I BOUGHT THIS EDISON-HOTPOINT!
THERE YOU ARE, RIGHT FROM "THE MAN WHO KNOWS"
RIGHT! LET'S SEE THE EDISON-HOTPOINT PEOPLE TODAY!

## DON'T OVERLOOK THE "DOUGH" IN BAKERY LOAD... *Get It With This New* EDISON-HOTPOINT ELECTRIC BAKE OVEN



Baker's like it because it's clean. Fast. Holds heat longer. Economical. Safe because it's flameless. Can be built up a deck at a time. Write for information today, NOW! Edison General Electric Appliance Co., Inc., 5618 West Taylor Street, Chicago, Illinois.

*Distributed in Canada by Canadian General Electric Company, Ltd., Toronto*

COMMERCIAL ELECTRIC EDISON Hotpoint COOKING EQUIPMENT

the tobacco in handling case, and the third section is conditioned to hold the tobacco in case ready for market.

•

## Light Makes Business for Shopping Centers

By T. H. SHEPHERD
Los Angeles Bureau of Power & Light,
Los Angeles, Calif.

Neighborhood shopping centers, which have been growing in importance for several years, were focal points for an activity of the Los Angeles Bureau of Power & Light which not only produced lighting load but also worked to the long-run benefit of the community as a whole.

An example in Los Angeles is a district known as Lincoln Heights. In any situation various cues indicating conditions which make it favorable to initiate mass action always present themselves in some form. In Lincoln Heights the cue for such an activity was the erection of the Department of Water and Power's Daly Street branch office. The district was old and the office was designed to be an example of modernity for the local merchants. It was successful in inspiring the idea that this whole business district would enjoy increased business if it dressed itself up.

The local chamber of commerce was a logical channel through which to effect a mass movement and members of the bureau's illumination section worked through this agency to present a program on "Modernization With Light." Front-page publicity in the local newspaper helped secure good attendance at these meetings. This beginning led busienss men of the district to ask the bureau to conduct a modernization survey.

A survey showed that 63 per cent of the establishments might well improve their building fronts to produce a good first impression; that 83 per cent of the signs needed modernizing; that 80 per cent of the show windows could be improved with profit; that 55 per cent of the interiors were very inefficient for the merchandising of goods.

This information, with a discussion of the findings, was turned over to the Chamber of Commerce, which gave it wide circulation. Prospects for lighting modernization came from many sources, including realtors, bankers, the chamber office—but were mainly the result of personal contact by the bureau's district power representative and illuminating engineer.

The follow-up has been aggressive and continuous, but has been directed not at high-pressuring sales by "once-over" methods, but at contributing to civic betterment.

Promotional materials have been the usual ones plus "after" pictures of the prospect's own premises, as conceived by the illumination staff artist. The actual Wolfe store (illustrated) is, for instance, almost a duplicate of the recommendations contained in the artist's sketch.

So far, in the twenty months following the initiation of the Lincoln Heights development, 40 installations and 84 promoted kilowatts, which are known to be a result of the activity, have been recorded. The original survey indicated that roughly 75 per cent of the business buildings needed some type of modernization with light. So far 40 per cent have made improvements. All of this was accomplished with the regular staff, without additional cost and without upsetting routine.

•

## Eleven Rules for Co-operative Plan

By R. E. BARD
Dealer Co-operation Department
Commonwealth Edison Company, Chicago

The voice of experience had a big say-so in the development of our company's policies for a two-way, mutually profitable dealer-utility co-operative plan, as follows:

1. Never call on a dealer with nothing more than the latest "Confucious saying" to offer.
2. Always try to keep up to date on company merchandising campaigns, terms, prices and advertising.
3. Call as regularly on dealers who are unfriendly or cool as those who are glad to see you.
4. Call on two new dealers every week without being asked to by a distributor or the dealer.
5. Don't peddle gossip even if you hear plenty.
6. Don't think up new plans just to look busy. Try to have a few good, sound, steady plans, measuring honestly your own enthusiasm for them.
7. Try not to oversell plans.
8. Don't let personalities enter into your business. You may have to "take" plenty from some unreasonable or misinformed dealer, but it is more than worth it when you finally make him a booster.
9. Sell co-operation on a straight business basis. It is better to say "No" now, if necessary, than to beat around the bush and disappoint a dealer after building up false hopes.
10. Consider dealer co-operation a business, not a party. Social life begins at 5 p.m.—with very few exceptions.
11. Design plans to help the dealer and the company—that is why we call them co-operative. Sell them as such to the dealers—not as favors or gratuities.

**BEFORE AND AFTER VIEWS of Wolfe's furniture store are typical both of the way the district appeared and of the type of modernization involved**

# WESTINGHOUSE LIGHTS TURNPIKE for *Visibility-Safety*

Illumination in the 6.7 miles of tunnels is provided by 1,060 Westinghouse flush-mounted mercury units. Tunnel approaches are lighted by 321 sodium vapor luminaires.

The nation's new "Dream Highway" . . . the 160-mile, Pennsylvania Turnpike . . . is lighted to new levels of visibility-safety by Westinghouse with mercury, sodium, incandescent and fluorescent lighting equipment.

At Turnpike terminals . . . tunnels and tunnel approaches . . . traffic interchanges . . . entrance ticket offices . . . gasoline service stations . . . Westinghouse lighting heralds a major advance in the "science of seeing" for motorists' comfort and safety. Illumination in the super highway's seven tunnels is as spectacular as it is effective. It marks the first use of High Intensity Mercury lighting in tunnels and also the first time four footcandle intensities have been attained in such an application.

Engineering counsel and information on Westinghouse TRAFFIC SAFETY LIGHTING for streets, highways and bridges is always available, whether the job is large or small. See your nearest Westinghouse Lighting Specialist, or write the Lighting Division, Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, Ohio.

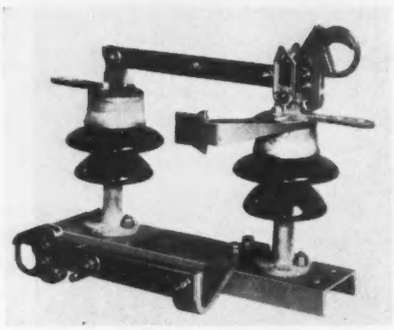
Tune in "Musical Americana," N. B. C. Red Network, Coast-to-Coast, every Thursday evening.

**Westinghouse Lighting Equipment**

# NEW EQUIPMENT

## Switch Improvements

Two new developments of this company include (1) expansion connector, shown mounted near an air-break switch, for use



Expansion connector (top); grounding blade (bottom). **Pacific Electric Mfg. Corp.**, San Francisco, Calif.

when long bus bars are connected to switches; (2) grounding blade for application to single-pole or stick-operated disconnecting switches.

•

## Galvanometer

High-sensitivity galvanometer. **General Electric Co.**, Schenectady, N. Y.

Suitable for many applications formerly requiring wall-type instruments, a new galvanometer is said to be more than three times as sensitive as previous models. Applications include temporary setups for factory and laboratory testing and permanent installations for testing instruments. Sensitivity of the instrument is attributed largely to arrangement of two fixed mirrors mounted inside the case, one on each end, increasing the effective light beam length. Alnico magnets are employed.

## Side Break Switch

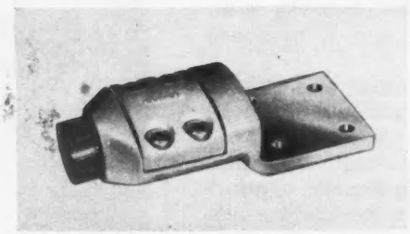
Two-insulator, side-break switch in ratings 7,500 to 69,000 volts, 400 to 1,200 amp., No. 57A. **Southern States Equipment Corp.**, Birmingham, Ala.

Reactance, voltage drop and losses, as well as weight, are said to be reduced in this new switch. Has pressure contacts held by bronze coil springs. Contacts are fully housed, full floating, self-aligning and self-wiping. Ball bearings and special, two-stroke blade motion make for easy operation. Switch is reversible from left to right opening and vice versa without any extra parts.

•

## Cable Terminal

This cable terminal has been "streamlined" to facilitate easy taping of the connector and to help insure a moisture-proof



Type "SNA-H" cable terminals; for all cable sizes up to 3,000,000 circ-mil. **Burndy Engineering Co., Inc.**, 459 East 133d St., New York, N. Y.

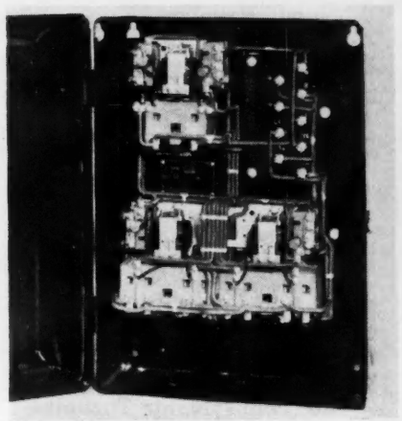
seal to the insulation. Recess at cable entrance permits end of cable insulation to be inserted into connector, shrouding and protecting cut end of insulation. Terminal illustrated has hollow head screws, but is also available with hexagon head cap screws set in recesses and tightened with socket wrench.

*[Text of this item is reprinted from "Electrical World," November 9, 1940, in which, by error, it appeared with wrong illustration.]*

**BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.**

## Across-the-Line Starters

Announcement is made of a new line of across-the-line magnetic starters for multi-speed squirrel-cage motors of 220 to 600



Across-the-line starter for a two-speed multiple-winding squirrel-cage motor. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

volts, 1 to 100 hp. Starters are designed to start the motor across-the-line at any speed, different speeds being obtained by changing the connections to the motor to change its number of poles. Features include pushbutton speed selection, accurate overload protection, low-voltage protection, "De-ion" arc quenchers, and front-of-board wiring.

•

## Safety Jacket

"Sleeve-Line" linesman's safety jacket. **Goodall Rubber Co.**, 5 South 36th St., Philadelphia, Pa.

Sleeve protectors are built into this linesman's coat. Arm and shoulder protection are furnished by a pure gum lining that runs down each sleeve and from the collar down 7½ in. across the shoulder blades. Rubber pants with straps are furnished with the jacket making a complete suit.

•

## Mercury Switches

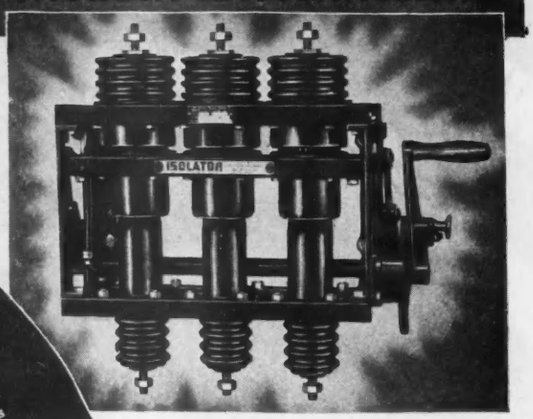
Catalog Nos. "A-5M" and "A-10Z" mercury switches. **Durakool, Inc.**, Elkhart, Ind.

Internal construction characteristics of these mercury switches have been changed

UPSWEEP!

ISOLATORS for Modern Disconnecting

"Three E"



Hundreds of standard and special applications of Isolators are now giving unparalleled service as disconnecting devices — for isolating oil circuit breakers between bus and cable — in switching cabinets — switching tables — in cubicles—in outdoor switch houses as a combination roof entrance bushing and disconnect — in series for double throw or transfer switching—in portable mining equipment and numerous other ways. There is an Isolator for your installation. Investigate!

Get these Benefits!

★ SAVES SPACE — Due to unique telescoping of insulators and current carrying parts, Isolators require no more installation space than their actual overall dimensions.

★ SAVES STEEL — Isolators, while maintaining proper clearances throughout, are so compact in design that great savings can be realized in cubicle structures.

★ SAVES INSULATORS — Terminal fittings are available on Isolators to carry bus, thus eliminating the necessity of bus supports.

★ SAVES CONNECTIONS — Isolators supplied with bus fittings eliminate necessity of other connections between bus and disconnect.

★ SAVES BARRIERS — Current carrying parts of Isolators are fully enclosed in insulation — no other form of barrier is necessary.

★ SAVES ACCIDENTS — Live parts of Isolators are completely shielded, and ends are arranged for easy taping — hence the possibility of accidental contact by operator is removed.

THREE E

Electrical Engineers Equipment Co.

MELROSE PARK ILLINOIS U.S.A.

MEASURE SPEED
without even seeing
the rotating element!

Because they measure speed simply by contact
"FRAHM" VIBRATING-REED TACHOMETERS
are the solution to a wide variety of speed-measuring problems, as well as for indicating rates of vibration. Types for permanent mounting as well as for hand use.
Write for descriptive Bulletin 1590-W.

JAMES G. BIDDLE CO. 1211-13 ARCH STREET PHILADELPHIA, PA.

to enable them to carry substantially greater currents than regular "Durakool" switches of same dimensions. Standard "A-5" switch, for example, is rated for 200 watts a.c. lamp load at an operating speed not over 20 times per minute. "A-5M," with same dimensions, has withstood 750,000 operations on 500-watt a.c. lamp load at operating speed of five times per minute 24 hours a day, the makers state.

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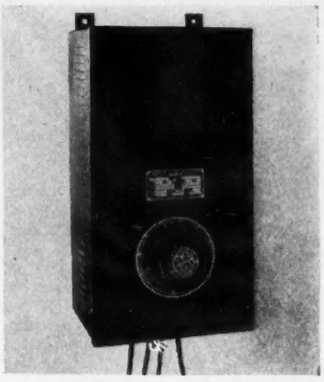
## Voltage Compensator

Manually operated, transformer-type voltage regulator has been designed to control a.c. voltage in small steps within a limited range and without circuit interruption. De-



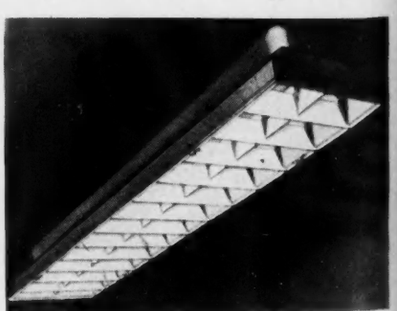
Type "LC" Transtat; standard types permit correction over range of plus and minus 10 per cent, available for service in 115-, 230- and 460-volt, 50- to 60-cycle circuits; single- and polyphase ratings from 2.5 to 85 kva. output. **American Transformer Co.**, Newark, N. J.

vice consists of an auto-transformer-type regulator connected across the line and an auxiliary buck-and-boost transformer with its secondary winding connected in series with the line. Voltage regulated either side of a center-tap in the winding of the regulator element is fed to the primary winding of the transformer, enabling either a bucking or boosting voltage to be set up in the secondary winding which is in series with the line.

•

## Lamp Shields

Additional shielding for this company's "Stream-Liter" industrial fluorescent lighting units is provided by metal louvers that clamp onto the reflectors and increase the shielding angle to approximately 23 degrees in all directions. Louvers are steel, designed in the so-called "egg-crate" con-



Louvers for "Stream-Liter" two- and three-lamp fluorescent fixtures. **Benjamin Electric Mfg. Co.**, Des Plaines, Ill.

# Centrifugally Cast . . . Certainly!
# But of COPPER!

NO, FAIRBANKS-MORSE is not the only electric-motor builder who casts rotor and squirrel cage winding into one piece centrifugally.

*But, only* Fairbanks-Morse makes a centrifugally cast rotor with the winding of COPPER.

Of course it's more difficult. It took a great deal of time and money to learn how to perfect the means of production.

But it makes a better motor because copper makes a better winding.

*Copper* has better electrical conductivity. *Copper* has better thermal characteristics.

Hence, the Fairbanks-Morse Motor with centrifugally cast, *one-piece* COPPER rotor winding is more capable of withstanding constant plugging and reversing. It gives added years of trouble-free service.

If you use motors, *this* motor is worth your detailed investigation and, if you like—comparison.

Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Illinois. Branches and service stations throughout the United States and Canada.

7780-EA40.154

*Copperspun*

FAIRBANKS·MORSE MOTORS

DIESEL ENGINES · ELECTRICAL MACHINERY · RAILROAD EQUIPMENT · WASHERS-IRONERS · STOKERS
PUMPS · FAIRBANKS SCALES · WATER SYSTEMS · FARM EQUIPMENT · AIR CONDITIONERS

**THE LINEMAN HAS FEWER POLES TO CLIMB**

"LARRY" is typical of many linemen throughout the country who now have fewer equipment replacements to make—thanks to sure-sealing gaskets of Armstrong's Corprene! Corprene can be depended upon to seal electrical equipment against the elements—to end expensive break-downs and power failures caused by gasket leaks.

**WHAT CORPRENE IS— WHAT IT DOES**

"Corprene" is the trade name for a group of more than two dozen cork-and-synthetic-rubber compositions. Made in sheets, cut pieces, and molded forms, these materials are impervious to liquids and gases and highly resistant to their destructive effects; also, to those of sunlight and corona. Corprene seals can be depended upon to keep oil in and moisture out—in most cases *for the life of your equipment.* Furthermore, their physical characteristics (compressibility and lateral flow, for example) are accurately "tailor-made" to specific requirements.

That's why Westinghouse uses Corprene gaskets in its transformers; why Line Material Company protects lightning arresters with Corprene gaskets; and why *millions* of Corprene gaskets, packings, washers, and other sealing units are efficiently serving industry today. Corprene should help solve any sealing problem *you* may have. What are your requirements? Armstrong Cork Co., Industrial Division, 908 Arch Street, Lancaster, Pennsylvania.

ARMSTRONG'S *Corprene*

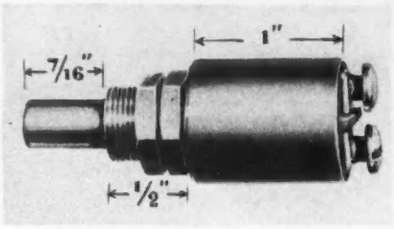
COMPOSITIONS OF CORK AND RUBBER-LIKE MATERIALS

struction and finished in white enamel. Two spring clamps on each side rail snap over the reflector bead to secure the louvers in position; unsnapping the clamps permits louver removal for relamping.

•

## Limit Switch

While this limit switch weighs only $\frac{5}{8}$ oz., it takes $\frac{3}{4}$-hp. motor, it is claimed. It has $\frac{3}{32}$-in. travel and the same amount of over-travel and is a double-break-type—two $\frac{1}{4}$-in. silver-contact buttons make and break on




"Clicker" limit switch; rated 110 volts, 6-amp. inductive load a.c. **Robert Hetherington & Son,** Sharon Hill, Pa.

two strips of solid silver. Long mounting nose permits adjustment for travel and over-travel.

•

## Metal Fume Respirator

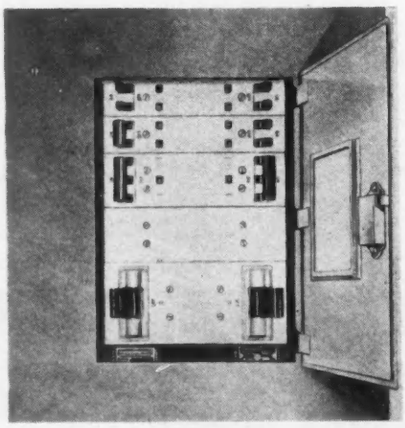
"M.S.A. Comfo Metal Fume Respirator." **Mine Safety Appliances Co.,** Pittsburgh, Pa.

Respiratory protections against fumes of metals generated when burning, pouring or molding lead, cadmium, zinc, etc., is provided for with this metal fume respirator. Unit is designed to permit use of goggles or headgear of any kind without interference. Maintenance requires periodic replacement of special metal fume filters.

•

## Panelboard

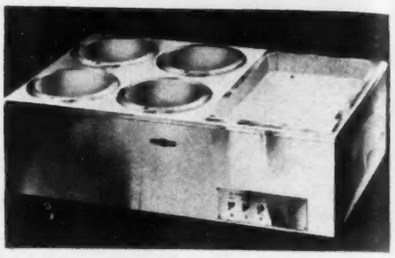
Circuit-breaker protection for branch-circuit lighting and power distribution is provided by a new line of dead-front distribution panelboards. They are equipped with fifteen 100-amp. common-trip branch breakers, 115 volts-230 volts a.c., single- and three-phase, suitable for use on ungrounded systems. Boxes are standardized; circuit-breaker units are interchangeable.



Type "MH" "Multi-Breaker" distribution panelboard. **The Trumbull Electric Mfg. Co.,** Plainsville, Conn.

## Food Cabinet

As a potential commercial load-builder, this company has brought out a five-unit



Hot-food service cabinet; rated at 1,650 watts. **The Wells Mfg. Co.,** 220 Ninth St., San Francisco, Calif.

hot-food service cabinet. Food is placed in standard insets and slipped into preheated wells, each with its own thermostat.

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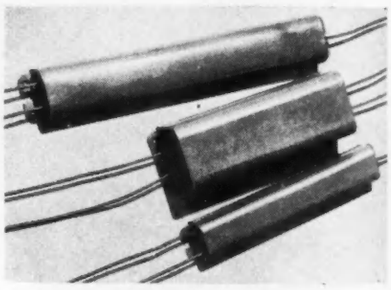
## Fluorescent Ballasts

New line of fluorescent lamp ballasts for use with separately-mounted starting switches includes single-lamp, normal or



All types available; includes ballasts for all lamp sizes, 50 or 60 cycles, 110-125, 199-216 or 220-250 volts. **Chicago Transformer Corp.,** 3509 West Addison, Chicago, Ill.

high power-factor ballasts and two-lamp high power-factor ballasts to minimize stroboscopic effect.

•

## TECHNICAL LITERATURE

FIRE PROTECTION—Diagrams of typical installations of carbon dioxide fire protection systems are included in an eight-page illustrated bulletin, "G-508," issued by Walter Kidde & Co., Inc., Bloomfield, N. J. Problems involved in adapting this system to various industrial hazards are described.

NEW BOOKLET TELLS HOW TO APPLY CAPACITORS—A new 28-page booklet which fully explains capacitor application on distribution circuits is announced by the Westinghouse Electric & Manufacturing Company. Containing theory, formulas, tables and charts, the new booklet tells how and where to apply capacitors when voltage drop is the controlling factor, where current carrying capacity is the controlling factor and where higher power factor is the requirement. Complete discussions of fundamentals, costs, sizes, locations and other elements of application make this booklet in reality a textbook of capacitor application. Effects of capacitors on telephone interference and on wave form are explained.

•

# MANUFACTURING - MARKETS

## Manufacturers Buy 98% in Home Market

Less than 2 per cent of the material needed for manufacture of electrical equipment must now be brought from abroad, according to Andrew H. Phelps, general manager of purchases and traffic of Westinghouse Electric & Manufacturing Co.

Progress in finding American sources or substitutes, Mr. Phelps said, has made it possible to reduce imports to a few essentials, of which there are ample supplies on hand. He declared that every state in the union now participates in these purchases for electrical manufacturers. Only about $2,000,000 goes for materials produced abroad. In many cases even these are processed in the United States.

Mr. Phelps said that his company annually buys about $100,000,000 worth of raw materials, finished parts, fuels, transportation and services.

•

## Allis-Chalmers Dividend

Allis-Chalmers Manufacturing Co. has authorized a dividend of 50 cents a share, increasing payments for the year to $1.50 a share, against $1.25 distributed in 1939. The company also announced that W. C. Buchanan, president of the Globe Steel Tubes Co., Milwaukee, was elected a director to fill a vacancy on its board.

•

## Expansion Program Voted by Johns-Manville Board

A $625,000 expansion program by Johns-Manville has been approved by the directors, according to President Lewis H. Brown. The program will include the installation of manufacturing equipment in the recently acquired plant at Zelienople, Pa., where insulating brick will be manufactured, and the building of new warehouses at the company's plants at Nashua, N. H., and Richmond, Ind.

Instead of meeting in the board room in New York, the directors went to the company's Manville, N. J., plant and spent the entire day in the various plant departments studying production and research activities.

•

## Blaw-Knox Dividend

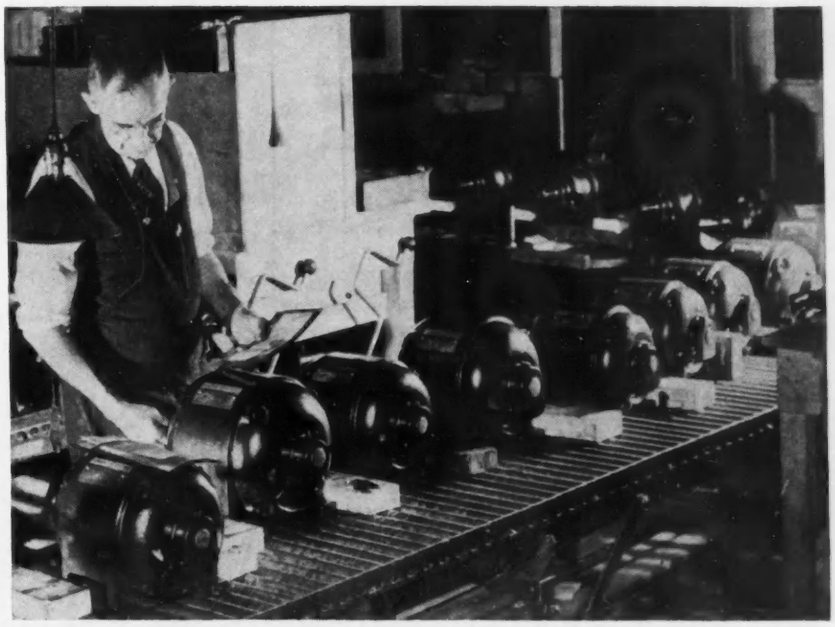
Blaw-Knox Co. has declared a dividend of 12½ cents a share on the common stock. The last dividend, a similar amount distributed on August 31, marked the resumption of dividends on the stock. W. P. Witherow, president of the company, reported that unfilled orders now were the largest in the company's history.

## Motor Changes Made by General Electric

General Electric Co. announced last week a completely new design of its line of general purpose polyphase induction motors. This new line represents one of the most extensive product changes in the history of the company.

The features of this new motor, known as the "Tri-Clad," are protection, smaller frame size for the same horsepower through the use of "Formex," improved bearing and lubrication design and streamlike appearance.

Mechanical protection is secured through the use of an almost totally inclosed cast-iron frame with openings located in the end shield and at the base for ventilation. Shaft deflection is reduced through shorter bearings and lubrication improved by a spiral type grooving. New manufacturing methods are employed.



**NEW G. E. motors in first check on production line**

# GIVE YOUR MANHOLE CREWS

## . . . this safe, convenient reel

★ Made of LAMICOID (Bakelite laminated)—an insulating and waterproof material

★ Light weight—yet tough and durable

★ Takeup reel holds about 150 feet of cable

★ 3 convenient outlets for light and appliances

PRACTICAL advantages of this new Epcolight* Reel recommend its use wherever installation or repair crews must make standard voltage connections for working lights, appliances, etc. It provides maximum safety for both workmen and the public . . . permits men to make all necessary connections in minimum time . . . and will give long, trouble-free service.

**VALUE-PROVED IN SERVICE**

Day in, day out—these reels have withstood constant service and tough usage on the streets of New York—and have been accepted as standard equipment for Maintenance and Emergency crews of Consolidated Edison Co. You, too, can eliminate hazards of outlet feed lines and speed setting-up time at the manhole with this Epcolight* Reel.

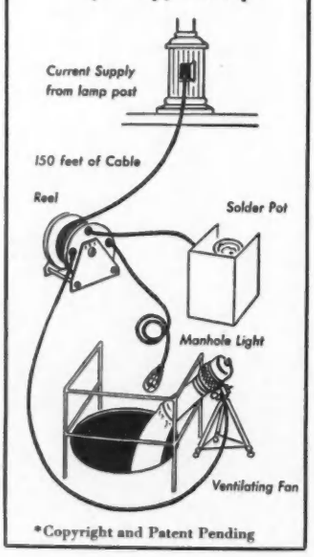
**ORDER A TRIAL REEL—NOW!**

It can be easily tested in service to prove that you should make this investment in safety for all your maintenance and emergency crews. The cost of an Epcolight* Reel is a very small premium to pay for safety. Write for further details and prices.

## MICA INSULATOR CO.

200 Varick Street, New York, N. Y.

**See how this *Epco light** Reel makes connections—quickly, safely!**




*Copyright and Patent Pending


## Manufacturers Issue Earnings Reports

Net sales of Johns-Manville and subsidiary companies for the third quarter of 1940 were $16,408,849, representing a 13.4 per cent increase over sales for the corresponding period last year. Sales for the third quarter were $14,474,596. Consolidated earnings for the third quarter this year amounted to $1,645,567, compared to a profit of $1,472,255 for the third quarter of 1939. Earnings per share of common stock, after preferred dividends, were $1.80 for the third quarter of 1940, compared to $1.58 per share for the corresponding period last year.

Among the other companies reporting profits were the following:

HYGRADE SYLVANIA—Net profit for eight months ended August 31 totaled $548,716. After preferred dividend requirements a balance of $458,032 was available for the common, equivalent to $2.21 a share on the 207,184 shares now outstanding. No comparison is available with earnings for the same period last year. The company states that during the first eight months of this year sales of fluorescent lamps and fixtures, a new development in its business, amounted to 19 per cent of total billings.

AMERICAN INSULATOR—Nine months to September 30, net profit, $96,367, equal, after preferred dividends, to $1.02 a share on common stock, against $48,962 or 35 cents a common share last year; gross sales, $1,043,029, against $925,091.

ROBBINS & MYERS, INC.—Year to August 31, net income, $443,598, equal, after preferred dividends, to $1.81 a share on 147,000 common shares, compared to $47,275, or 47 cents a share on 100,810 shares of preferred stock, for preceding fiscal year.

EUREKA-VACUUM CLEANER — Seven months to July 31, net loss $117,686 and net sales $1,179,199. Exact comparison with last year is not available, but for six months ended June 30, 1939, company showed net loss of $70,656 and for the calendar year 1939 one of $317,908. Fiscal year has been changed to end on July 31.

•

## Revere Plans Refunding

Revere Copper & Brass, Inc., New York, has filed a registration statement with the Securities and Exchange Commission covering $7,500,000 of 3¼ per cent first mortgage sinking fund bonds, due November 15, 1960. Funds will be used for refunding.

### New York Metal Prices

| | Nov. 13, '40 Cents per Pound | Nov. 6, '40 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 12.00* | 12.00* |
| Lead, A. S. & R. Price | 5.80 | 5.65 |
| Antimony | 14.00 | 14.00 |
| Nickel, Ingot | 35.00 | 35.00 |
| Zinc, Spot | 7.64 | 7.64 |
| Tin, Straits | 51.00 | 51.00 |
| Aluminum, 99 Per cent | 18.00 | 18.00 |

*Delivery Connecticut Valley.

# NO SUPERLATIVES . . . JUST MEAT

The Chinese had an old proverb, "A picture is worth a thousand words." So we took a tip from the old saw and put it into our 1941 catalog on Hi-Line Hardware.

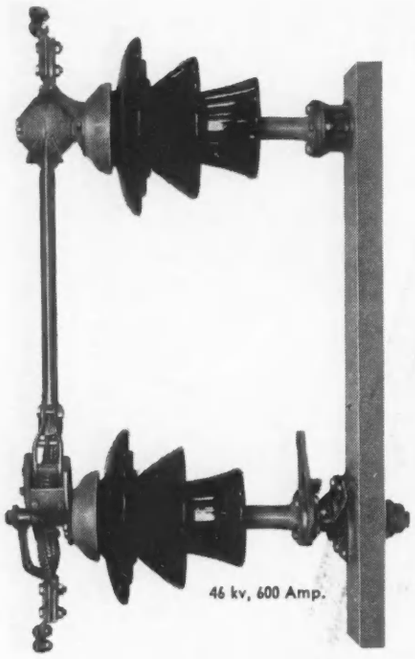
No superlatives, no long winded adjectives, just a reference book of good old blue prints with the vital information in an easy way to catch at a glance.

For the man who wants to pick up a catalog he can get his teeth into without wading through pages of type—this is it.

B.T.C. goes to press and the 1941 edition will be ready shortly. Please write us now so we can make sure that you receive your copy.

THE BREWER-TITCHENER CORPORATION . . . . . CORTLAND, NEW YORK

**MORE THAN A FORGING . . . A *SERVICE***




*Have You Seen the 57A, the New Switch?*

**Briefly, here are a few facts about this new, two insulator, side break switch:**

**Straight line copper conducting circuit gives current the simplest, shortest electrical path through the switch. Reactance, voltage drop and attendant losses are reduced; also eliminates excess weight and gives the 57A trimness that adds to your station's appearance.**

**Housed, full-floating contacts are self-aligning and self-wiping. Bronze coil springs apply constant pressure that assures firm contact at all times.**

**Operation is positive even in freezing weather. The contact and hinge assemblies provide full ice protection. All control arms and cranks exert ice-breaking leverages.**

**The special 2-stroke blade motion eliminates back-breaking efforts required to operate old type switches. And ball bearings, of course, add to the smooth, easy operation.**

**Reversible parts make it possible for the 57A to be converted from a left-hand to a right-hand switch (or vice versa) in the field. No extra or exchange parts are needed.**

**Investigate the 57A, the *new* switch built to meet growing demands. Talk with your Southern States' representative or. . . .**

***Send for Bulletin No. 365 Now***

**Southern States**

**Equipment (SS) Corporation**

**28 S. 20th St., Birmingham, Ala.**

# Field Reports on Business

*Electrical manufacturers report a wide variety of orders being received, with indications of greater volume as the national defense program progresses. Utility buying is expected to expand further as 1941 construction budgets take shape. Building materials are in great demand under private and government construction programs.*

## NEW YORK

For the present the prospects are that there will be no change in the attitude of government toward business. Government policies will be continued, probably with greater force. The national defense program is now the great impetus to industrial production and will occupy greater space for the next year or so. To the opposition to increasing the national debt limit, the government is likely to offer a further increase in taxes.

Retail trade has been spotty of late with a falling off in some lines. Efforts are being made to prevent a too sharp rise in prices, but indications are that higher prices are to be the order.

Many electrical manufacturers are expanding plants to take care of defense orders. Domestic orders have increased to the point where production facilities must be expanded. Question now is to what extent will the government demand priority.

Orders received by manufacturers indicate demand for regulators, synchronous motors, capacitors, network protectors, switchgear, breakers and a wide variety of other equipment. Utility buying is expected to become more pronounced as 1941 construction budgets take shape.

*Engineering News-Record* reports engineering construction awards for last week 57 per cent higher than a year ago. Private construction is up 11 per cent and public awards top a year ago by 89 per cent.

## NEW ENGLAND

Electrical equipment buying in this district continues at a fast pace and the volume of orders for the current year to date surpasses any records previously established. A few items noted in recent bookings indicate the activity in various lines; during the last fortnight twenty 30,000-hp. naval propulsion units were ordered for delivery to shipyards in this district, where government contracts for destroyers have been allotted; the Boston & Main R. R. has purchased four Diesel-electric switching engines, each rated at 380-hp. and capable of making 35 miles per hour and costing $35,000 each. They will be built by General Electric at the Erie shops.

Motor sales are very buoyant; last week more than $18,000 in motors was booked from one division office in this district; the demand for large motors, ranging from 100-hp. up, is brisk and fractionals are moving in large quantities due in part to a heavy demand from manufacturers of portable contractors' tools, appliance manufacturers and others.

Central station supplies are receiving increasing attention. Boston Edison has authorized a further extension of its secondary network in the Back Bay district involving from 20 to 25 transformer vault installations ranging from 150 to 300 kva. A Massachusetts utility has installed 3,600-kva. in Cornell-Dubilier capacitor equipment with automatic control of power factor. Hartford Electric Light Co. is installing a three-phase, low-voltage network in the center of the city requiring seven 11-kv. primary feeders and nineteen 500-kva. transformer units for vault installation. Last week four 2,000-kva. Allis-Chalmers transformers were bought by the War Department for erection at cantonments now under construction in this area and $27,686 worth of Westinghouse transformers was booked for similar location. Substation apparatus costing in the neighborhood of $20,000 has been purchased for Maine and wiring contracts totaling more than $32,000 have been allotted for light and power equipment installation in quarters now being built at army training posts in New England.

## CHICAGO

The level of most lines of business in this area climbed still higher during the past week, with industrial activity setting the pace. Electric power output and retail trade registered substantial gains over the previous week and widened the margin of increase over a year ago. Wholesale trade is booming, with large orders reported for the holiday season, which is expected to run well ahead of last year. Buying was brisk at the fall home furnishings mart as sales recorded an average gain of 14 per cent over the previous year.

The majority of electrical manufacturers report orders being received at a rapid rate. The demand for industrial equipment is creating considerable backlogs and necessitating extended delivery dates in many lines. The demand for motors, control apparatus, transformers and welding equipment is exceptionally good and growing rapidly.

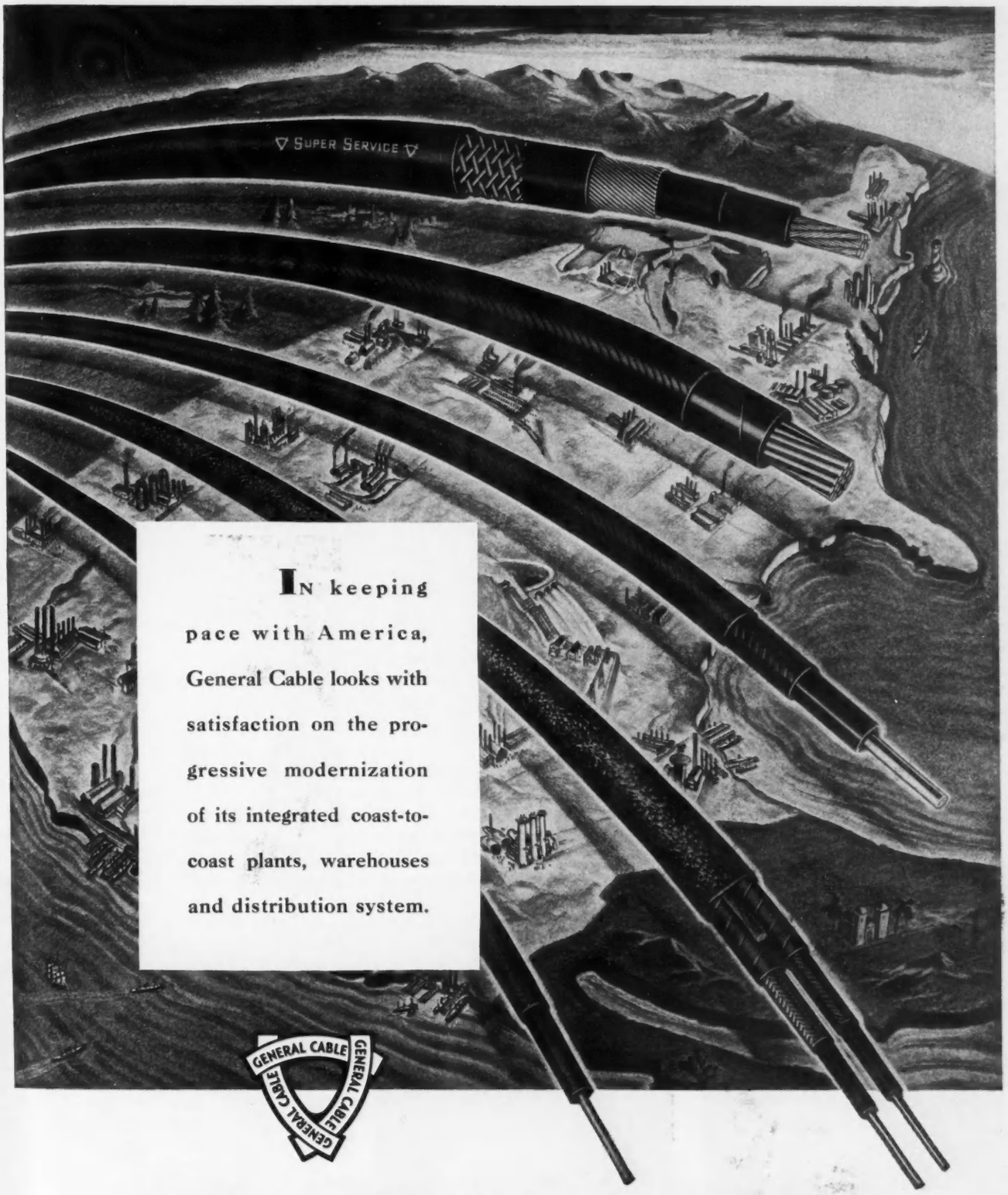
Wisconsin Electric Power Co. will start a $7,660,000 expansion program, including a 23-mile transmission line and the increase of generating capacity at Port Washington and Grandville. A local brewing company is installing two generators and an ice machine at a cost of $25,000. Bliss & Laughlin, Inc., is expanding its annealing plant at a cost of $125,000, including new furnaces and cranes.

## PACIFIC COAST

Building permit total for October for the seven western states exceeds by 40 per cent that for October last year and is 4 per cent better than for September, 1940. Small home building provides the greater portion of these totals. November defense housing awards have already included $1,897,000 for 600 dwelling units in Alameda, opposite San Francisco; $1,575,000 for 450 units in Kodiak, Sitka and Unalaska, and $7,000,000 for 1,300 units near Honolulu, all these awards being on a cost plus fixed fee basis.

Pacific Gas & Electric Co. is to construct a 28,000-hp. hydro-electric plant at Dutch Flat, Placer County, Calif., costing $3,210,000, plus $570,000 for transmission lines, scheduled for 1943 completion. Pasadena, in southern California, plans a two-million-dollar 35,000-kw. steam-generating plant.

Industrial developments include a $640,000 Douglas oil cracking plant and refinery near Los Angeles and a $400,000 modernization job for the Union Oil headquarters there.




IN keeping pace with America, General Cable looks with satisfaction on the progressive modernization of its integrated coast-to-coast plants, warehouses and distribution system.

GENERAL CABLE

# GENERAL CABLE

**BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE**

*General Cable Corporation Sales Offices:* ATLANTA · BOSTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DETROIT · HOUSTON · KANSAS CITY (MO.) · LOS ANGELES · NEW YORK · PHILADELPHIA · PITTSBURGH · ROME (N.Y.) · ST. LOUIS · SAN FRANCISCO · SEATTLE · WASHINGTON (D.C.)

# NEWS ABOUT PEOPLE

## Curtis Lighting Elects Four New Executives

Curtis Lighting, Inc., has recently announced the appointment of three vice-presidents and a secretary-treasurer. M. C. Wilt has been appointed vice-president and general manager. Working with him are three newly appointed officers: G. T. Morrow, vice-president in charge of sales; H. J. Dillon, vice-president in charge of production, and L. N. West, secretary-treasurer.

*Blank & Stoller*

**M. C. Wilt**

Mr. Wilt has had eighteen years in the lighting business and the completeness of his experience in engineering, selling, production and management, give him an excellent background for his new executive position. Before joining Curtis in 1928, he was connected with Ohio Power Co. in Lima and with the Appalachian Electric Power Co. in Huntington, W. Va. In 1931 Mr. Wilt organized Curtis Lighting of Canada.

Mr. Morrow became identified with Curtis Lighting in 1923. In 1931 he was appointed assistant sales manager. In this position he spent seven years and obtained a complete knowledge of coordinating the sales work of all territories. For the past two years he has served as sales manager.

Since 1935 Mr. Dillon has been connected with Curtis Lighting. Previously he had been connected with the King Manufacturing Co., Buffalo, the Amrad Corp., Bedford Hillside, Mass., and Magnavox Co. of Fort Wayne, Ind.

Mr. West was associated with Sprague, Warner & Co. before joining Curtis Lighting.

*Blank & Stoller*

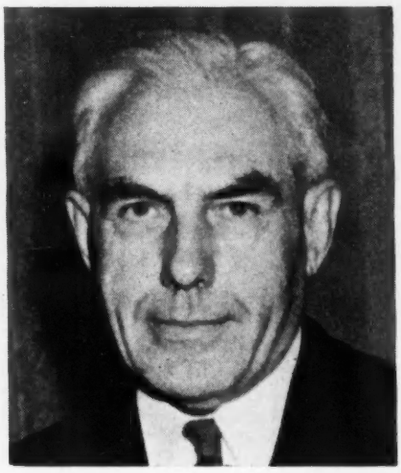
**G. T. Morrow**

*Blank & Stoller*

**L. N. West**

## E. O. Shreve, G.E. Executive Elected to Head N.E.M.A.

E. O. Shreve, vice-president of the General Electric Co. in charge of apparatus sales, newly elected president



of the National Electrical Manufacturers Association, was born in Mapleton, Iowa, October 21, 1881. His election to the N.E.M.A. office came on his birthday.

Following graduation from Iowa State College in 1904, Mr. Shreve joined General Electric as test man and later was sent to the supply department. In 1906 he left for San Francisco as a supply salesman, covering all of the San Francisco outside territory for General Electric. In 1907 he was given responsibility of the Nevada territory on all lines of G.E. equipment and supplies. Back at the San Francisco office in 1909 as a turbine specialist, Mr. Shreve became an apparatus salesman the following year. In 1912 he was given charge of sales to the Pacific Gas & Electric Co.

From assistant manager of the San Francisco office in 1916, Mr. Shreve moved into the manager's chair in 1917. In 1926 he was appointed manager of the industrial department of the Gen-

# MOUNTAIN GRADES—AXLE-DEEP DESERT SANDS—112° TEMPERATURES

# But FWD's DELIVER RIGHT TO LOCATION!

The hauls are tough — over rough terrain: mountains, deserts and lowlands—building that line of transmission towers between Los Angeles and Boulder Dam! 112° temperatures are frequent, and axle-deep desert sand doesn't make for easy going for a heavily loaded line truck.

It's a job that calls for the full power of four driving wheels, and the Los Angeles Department of Water and Power depends on FWD's to deliver men and materials right to transmission tower locations, where the work is to be done.

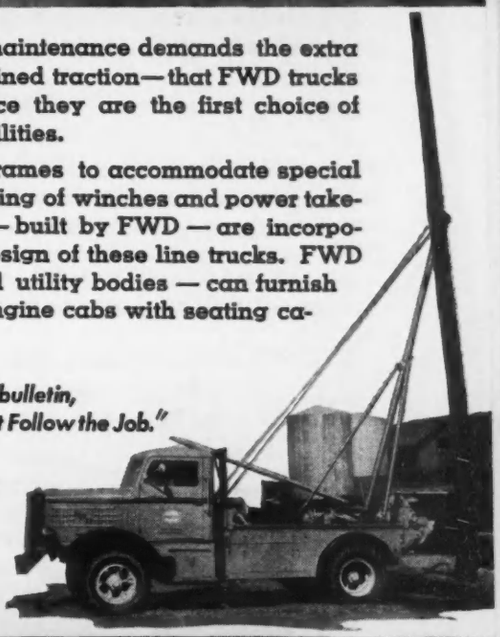
Line construction and maintenance demands the extra performance—the sustained traction—that FWD trucks provide. For this service they are the first choice of more than 150 Public Utilities.

FWD's are built with frames to accommodate special tools, bodies, the mounting of winches and power take-offs. Boring machines — built by FWD — are incorporated in the original design of these line trucks. FWD builds its own cabs and utility bodies — can furnish conventional or over-engine cabs with seating capacity of 2 to 7 men.

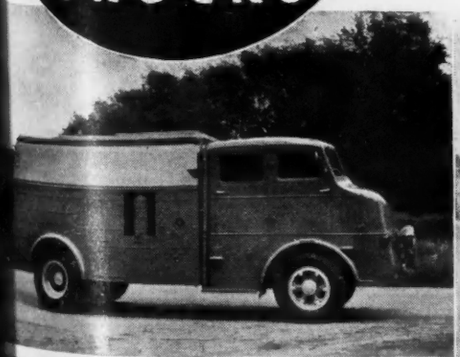
*Write for FWD bulletin,*
*"Public Utility Trucks That Follow the Job."*

**FWD TRUCKS**

**THE FOUR WHEEL DRIVE AUTO COMPANY**
**CLINTONVILLE, WISCONSIN**
***Canadian Factory:* Kitchener, Ontario, Canada**



*FWD Boring Machine Unit built for Midwest Utility. Digs pole holes in quicksand, clay, shale, rock, all soils.*



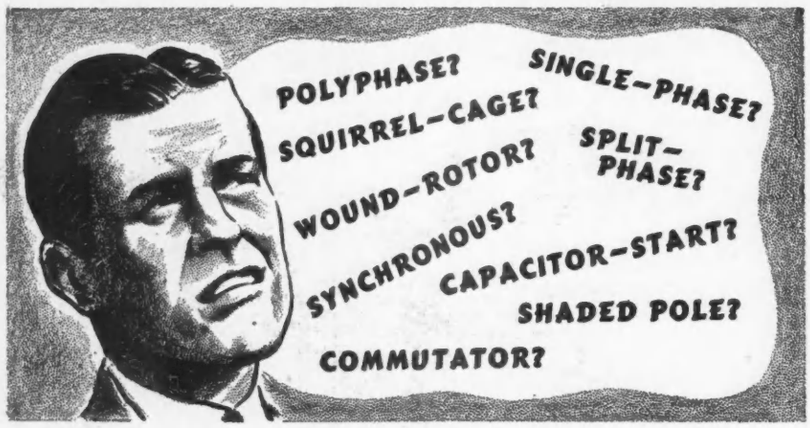
*WD for coastal defense service of the U. S. Coast Guard. uipped with special body for the carrying of materials d delicate instruments in moisture-proof compartments.*

*FWD Model HST Boring Machine Unit built by FWD for service at Bonneville Project, Oregon. Has pole derrick and complete line equipment.*

*FWD typical line construction and maintenance service trucks — complete with drum winch, pole derricks, and full line equipment.*

# WHY BE "IN A FOG"

## ABOUT A-C MOTOR SELECTION?




## LET GraybaR AID YOU IN FITTING MOTORS TO THE JOB

When you put your motor and motor-control problems up to GRAYBAR, you get a double assurance of sure performance: (1) GRAYBAR offers the complete line of *General Electric* motors and controls — backed by G-E research and manufacturing facilities — the line which GRAYBAR experience has proved of greatest value to its customers; (2) GRAYBAR representatives and specialists "on call" are prepared to assist you in choosing the right equipment for the job — service to you is their primary responsibility.

Whether you're selecting motors for plant motive power or types to be "built on" to equipment for resale — it will pay you to put your problem up to GRAYBAR.

**GRAYBAR ELECTRIC CO.**
**Graybar Building,**
**New York, N. Y.**

**SPLIT-PHASE MOTORS for Fractional HP Service**

For small power tools, pumps, fans, business machines and domestic devices, G-E split-phase motors offer many special advantages in the 1/60 to 1/3 h.p. range. Write GRAYBAR for new bulletin "Split-Phase Motors —Type KH" for full details.

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This free booklet, "How to Select A-C Motors and Control," contains nine factual articles on the special characteristics of different type motors, service factors, capacity ranges, etc. Write GRAYBAR for your copy.

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eral Electric Co. at Schenectady and in 1929 became assistant vice-president to J. G. Barry, then vice-president in charge of sales. In 1934 Mr. Shreve was elected a vice-president.

•

▶ O. H. GOLBERG has been appointed assistant sales manager of the Eureka Vacuum Cleaner Co., Detroit, in charge of advertising and sales promotion. In this position Mr. Golberg will maintain supervision and correlation between Eureka's sales programs and sales promotion activities. Mr. Golberg brings to his new assignment wide experience in both advertising and sales work.

▶ H. B. LEWIS, manager of power sales of the Kansas City Power & Light Co., has been appointed manager of the North Kansas City office of the company. Mr. Lewis fills the vacancy created by the retirement of the former manager, H. A. BRUNNER. F. A. GRAHAM, who has been associated with Mr. Lewis since 1919, succeeds to the position of manager of power sales.

▶ EDWARD D. KING, vice-president of the Buffalo Niagara Electric Corp., was honored recently in Buffalo for his long service with the company at a dinner attended by about 100 associates, including executives from Buffalo, Niagara Falls and New York City. Mr. King became identified with the electrical power industry of the Niagara frontier in 1905.

▶ LEON R. LUDWIG has been appointed manager of two newly combined sections of the switchgear division of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh. Mr. Ludwig, who has been manager of protective devices engineering for the last five years, will head the combined division of circuit breaker and protective devices engineering. PAUL O. LANGGUTH, who has been in charge of small oil breakers in the circuit breaker division, has been appointed assistant manager of the new division.

▶ EBEN B. HASKELL, formerly power sales engineer with the then Tenney properties at Boston and later in similar work with the New England Power Association system with headquarters at Lowell, Mass., has been appointed head of a newly organized lighting sales and promotional department for the United Illuminating Co., New Haven, Conn. He has been in the utility field in New England for the past fourteen years and will report to C. A. Williams, vice-president. SIDNEY F. MACLEAN, formerly with the Boston Edison, Erickson Electric (Chicago) and Hy-Lite Corp. of Boston, has been named lighting engineer for the New Haven

territory. MATTHEW V. BRINKERHOFF, who has been connected with the Central Hudson Gas & Electric Co., Electric Vacuum Cleaner Co. of Cleveland and Electric Supplies Co., Hartford, Conn., has been placed in charge of lighting activities in the United's Bridgeport district.

▶ ROBERT D. STUART, JR., for some years general sales manager of the Fall River (Mass.) Gas Works Co., has been appointed general sales manager of the Blackstone Valley Gas & Electric Co., Pawtucket, R. I. He succeeds the late William E. McCreery.

▶ HARRY L. WILLIAMSON, formerly assistant manager of cable sales for the General Electric Co., has been appointed manager of sales promotion for the Locke Insulator Corp., a General Electric affiliate, with headquarters in Baltimore, Md. Mr. Williamson has been associated with General Electric since 1928.

▶ CHARLES R. PRITCHARD, manager of specialty appliance sales for the General Electric Supply Corp., Bridgeport, Conn., since 1937, has been appointed a vice-president of the corporation and RALPH J. BROWN, who has been connected with the Supply Corporation since 1929, has also been appointed a vice-president.

▶ GEORGE WILMARTH, chief operating engineer of the Northern States Power Co., Minneapolis, for the past thirteen years, recently resigned his position because of ill health. Mr. Wilmarth first became associated with the Standard Gas & Electric Co., parent organization of Northern States Power Co., when he became general superintendent of the Red River Power Co. at Grand Forks, N. D., in October, 1910. He subsequently became associated with the Oklahoma Gas & Electric Co., which he left in 1923 to become manager of the Wisconsin division of the Northern States Power Co. at Eau Claire. He was appointed chief operating engineer of the Northern States Power Co. in 1927.

▶ WALKER R. YOUNG has been appointed assistant chief engineer of the Bureau of Reclamation. Mr. Young is supervising engineer of the Central Valley Reclamation project in California. His new position will take him to Denver, Colo., the field headquarters of the bureau. After joining the bureau in 1911 as assistant engineer, he worked on the Arrowrock Dam in Idaho, headed the mechanical and dam division of the designing department in the chief engineer's office in Denver and was in charge of field investigations in connection with the development of the Colorado River, formulating the original designs and estimates for Boulder


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FOR COMMERCIAL USE—MIRALUME HF-201: 200-watt unit; 4 40-watt tubes; approximate length, 50".

INDUSTRIAL MIRALUME F-100: 100 watts; 2 40-watt tubes; approximate length, 54". No nuts or bolts in reflector surface.

***SHOWN HERE*** are two of many MIRALUMES available. The only Fluorescent Light units made *complete*—with lamps, fixtures and starters—under *one* roof! Designed, engineered, built and *guaranteed* by HYGRADE. Corrected for power factor and stroboscopic effect. Supplied wired and ready to install, or unwired, if desired. Starters easily accessible. Completely guaranteed. Quality manufactured to meet with the approval of the Underwriters Laboratory, Inc.

Offer to test Hygrade Fluorescent Lamps against any other lamps in any fixture. Tape over the maker's name on both sets of lamps. Then let the customer decide! (We've used this test with sensational results!).

**NOTE:** Extraordinary lighting efficiencies are obtained in fluorescent lamps, and by tuning the electric discharge to concentrate ultra-violet energy at the precise 2537 Angstrom Unit wavelength most effective in causing the porous film (Hygrade patent 2096693) to generate light, the best results are secured. The means for achieving these results so important to the efficiency of HYGRADE LAMPS, are described in patent numbers 2126787 and 2201817 now controlled in this field by HYGRADE. The high power factor non-stroboscopic circuit used in this unit is described in Hygrade patent No. 2195114.

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| BINGHAMTON, N. Y.<br>BINGHAMTON 4-5314 | BALTIMORE, MD.<br>PLAZA 7656 | NEW CASTLE, PA.<br>NEW CASTLE 2285 |
| COLUMBUS, OHIO<br>ADAMS 5432 | ALEXANDRIA, VA.<br>ALEXANDRIA 3581 | RUTHERFORD, N. J.<br>RUTHERFORD 2-7434 |

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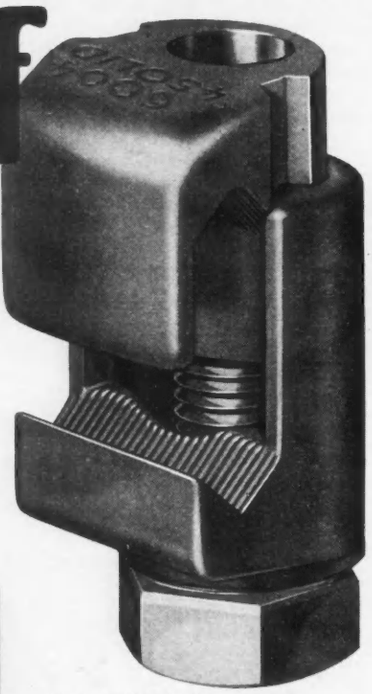


THE NEW FARGO "6000" CONNECTOR


Dam. Subsequently he was detailed to an investigation of the salt water incursion from Sacramento Bay into the Sacramento and San Joaquin Rivers, and then was appointed construction engineer of the Kittitas division of the Yakima Reclamation Project, Washington. In 1931 he was designated construction engineer in charge of the building of Boulder Dam, holding this position throughout the construction period. He was placed in charge of the Central Valley project in 1935.

▶ EARL N. GRAF, formerly manager of the Pittsburgh branch of the John A. Roebling's Sons Co., has been appointed assistant manager of sales, wire rope division, with headquarters at Trenton, N. J. His first association with the Roebling Co. came indirectly in 1919, when he took over specialized wire rope sales for the Frick & Lindsay Co., a Roebling distributor in Pittsburgh. He subsequently became wire rope specialist with Frick-Reid Supply Corp., successor to Frick & Lindsay. In 1938 Roebling opened a branch office in Pittsburgh and Mr. Graf was put in charge of wire rope sales and in 1939 became manager of the branch, where he remained until his recent promotion.

## OBITUARY

▶ WILLIAM W. MALLORY, president of the city-owned Memphis (Tenn.) Light, Gas and Water Division, died at his home in that city on November 4, after a lengthy illness. He was 65 years of age. A native of Memphis, Mr. Mallory attended the University of Virginia. For many years he was associated with his father in the management of a wholesale grocery, relinquishing that connection to head the combined utility system after the city's purchase of the Memphis Power & Light Co. in 1939.

▶ EDWARD LYNDON, electrical engineer and brother of the late Lamar Lyndon, died, of heart disease, at his home in Westport, Conn., November 6, after a long illness. His age was 61. Born in Athens, Ga., he was graduated from the University of Georgia. Mr. Lyndon made important contributions to the development of searchlight mirrors for the Engineers Corps of the United States Army during the World War and served on several boards during and after the war. He was commissioned in the Engineers Corps, retiring as major. Following graduation from the University of Georgia, Mr. Lyndon became associated with the Gould Storage Battery Co. of New York. He was a frequent contributor to engineering and technical publications.

## Load Conditions on R.E.A. Lines

[*Continued from page 65*]

appliances and the use of more off-peak loads in the farm industries.

*Curve B, Demand vs. Consumers*—Here the demand data were corrected to average consumption by the use of a straight proportionality and curve A, since the consumption was not constant for the entire curve. Consequently the curve represents the relation of demand per consumer to number of consumers for the consumption of 53.8 kw.-hr. per month.

*Curve C, kw.-hr. per month per kw. vs. Consumers*—Curves of maximum substation demand that can be expected from any size system for various values of consumption can be derived from this curve and curve A. Values from curve C are divided by the consumption for which the demand curve is desired, giving the coincident demand per consumer. These figures must then be corrected by a factor taken from curve A. This is necessary because in using curve C for any value of consumption other than the average value of 53.8 kw.-hr. per month, one is assuming that demand and consumption are directly proportional. Curve A indicates this is not true, and thus a correction factor of

$$\frac{\text{the actual curve value}}{\text{the straight-line value}}$$

for the consumption desired must be applied to the data before plotting.

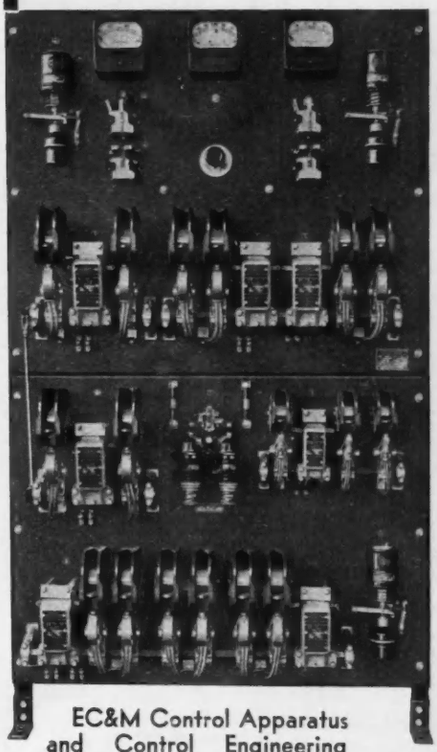
Average system load factor for systems with more than 600 customers is about constant and equal to 206/720, or 28.6 per cent, based on kilowatt-hours metered at the members' meters, or about 40 per cent, a more correct value, based on kilowatt-hours metered at the substation.

*Curve D, Losses vs. Density*—This curve was constructed to show the already known fact that losses decrease as density increases. It appeared to be a straight line for the section covered; it will of course rise to 100 per cent at zero density.

From the curve of coincident demand per consumer versus consumers (curve B) it is possible to obtain a diversity curve, by dividing the demand for a one-consumer system, the intersection of curve B and the vertical axis, by the various values on the curve. However, because

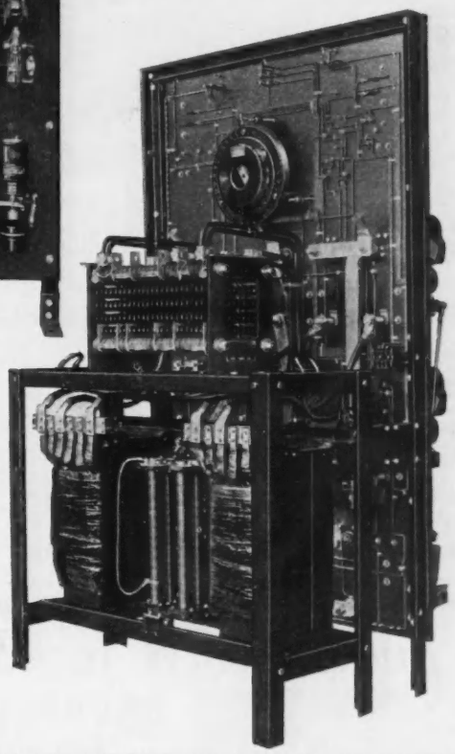

...THEY COULDN'T AFFORD A SHUTDOWN!

*M-G Set Brought Up To Speed Safely —and Without Tripping Breaker*



Customer's power service was loaded to capacity. A Standard Motor Starter was tried out but it frequently failed to bring the motor up to speed without causing the main power breaker to trip and shut the whole plant down.

An EC&M representative was called in. The starter recommended by EC&M performed successfully from the beginning and has not caused a single shutdown.



EC&M Control Apparatus and Control Engineering rank at the top for the solution of difficult control problems. This EC&M Combination Auto-transformer and Primary-resistor Starter for reduced voltage starting of 400 HP, 440 Volt Synchronous Motor-Generator Set is only one of many illustrated and described in our 24-page Booklet No. 88 on Custom Built Motor Control. Mail the coupon today for your copy.

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Eighteen special or semi-special units match nearly every installation and engineering problem—yet all eighteen are capable of still further modifications to make them *right* for your job.

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***—AND YOU'LL BUDGET LESS FOR FUTURE POLE REPLACEMENTS!***

New York State utilities have treated over 50,000 poles with Osmoplastic since 1934. Names on request.

AT a cost of only $1 to $2 per pole (including labor) Osmoplastic Groundline Treatment extends pole's service life 7 to 10 years—a handsome dividend on your modest investment in the treatment, and a still greater dividend in protection to your investment in poles themselves. Treatment is simple as A-B-C. Effectiveness positively proved by experience of more than 50 leading utilities. Write for literature.

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of the steep slope of the curve at the axis, this intersection cannot be determined accurately, and so the value must be obtained from individual consumer load studies. In case diversity is wanted, therefore, it will be necessary to approximate the individual consumer demand for the consumption in question. From curves A and C, however, it is possible to predict substation demands for any number of consumers, making the question of diversity one of academic interest rather than a requirement in the design of a rural system.

## Integrated Program Improves Reliability

[*Continued from page 58*]

the ground relays No. 51G1 and 51G2 are in operating condition and a green lamp to indicate an abnormal current flowing in the station ground resulting from a ground fault somewhere in the system.

### *Additional Differential Burdens*

During transient conditions there is a tendency for fictitious differential current due to unfaithful performance of current transformers. Part of the unfaithful performance of current transformers is due to unequal burdens in current transformer secondaries which cannot be avoided because of physical locations. Additional burdens, by use of resistors, are, therefore, added in series with the relay-operating coils so as to reduce the effect of unequal current transformer regulation.

### *Modernization of Oil Breakers*

The original installation of breakers on the 13.2-kv. station set-up consisted of General Electric, type H6, 1,500- and 2,000-amp. switches on all generator and bus-sectionalizing positions. The outgoing feeders were equipped with type H3, 500-amp. switches. Both types, H6 and H3, would throw oil in clearing heavy faults, which resulted in high maintenance cost as well as fire hazard. The manufacturer's derating on this class of breaker made it necessary to rebuild 21 of the type H6, making them type H206. This increased the rupturing capacity from 350,000 to 1,000,000 kva.

Seventy of the feeder breakers were rebuilt, converting them from H3 to

modernize
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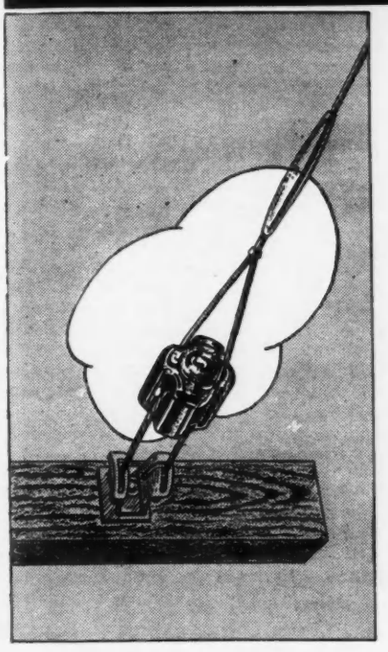

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Reliable double D deadend - adapters permit deadending with a standard splice — easily slipped around a spool or through a strain insulator.

For economy in stocking, and convenience in installation.

Will hold wire to full breaking strength.

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type H103 and on 26 of type H103 the exhausting piping from the separating chambers was changed from iron pipe to pipe constructed of insulating material. As all feeders are equipped with reactors, additional rupturing capacity was not needed. The primary need was oil-tight tanks, reducing to some extent the fire hazard and cost of maintenance.

A change from iron pipe to pipe and fittings made of insulating material was brought about by a bus fault which occurred in July, 1939, that was attributed to the iron pipe within the switch cell compartment. This case of trouble merits the attention of engineers who have similar switchgear installations.

### *Lightning Strikes*

The trouble occurred during a severe electrical storm at the time of peak load on the station. The feeder involved, equipped with type H103 breakers, leaves the station underground for approximately 340 ft. to a terminal pole, where arresters are located, and continues on from there as an overhead line. The first customer's station is approximately 2 miles distant, and from there on additional customer stations are located from one-half to one mile apart, with arresters at each station. During the storm the feeder had relayed three times on rather heavy faults. Several minutes after the third relay, with the breaker still in the open position, the line was again struck by lightning.

Overvoltage from the line flashed over the porcelain bushing at the top of the tank of the breaker on the line side and then over the bushing on back tank which was connected to the 13.2-kv. bus. The arc flashed from the cross-head and contact rods to the iron vent piping of the separating chambers, resulting in a bus fault to ground and finally developed into a phase-to-phase fault on the bus. The clearance between cross-head and the iron piping at top of cell, with switch in the open position, was, in some cases, not in excess of 2½ in. This type of breaker, 15 kv. rating, has at least a 36-kv. insulation level, and the line to which it was connected has a somewhat higher insulation level. By replacing the iron piping with piping of high dielectric insulating material, all grounded conducting material is removed from the switch cells.

. . . READ THIS OPERATING COMPANY'S REPORT . . .

**18 new test installations per day with the MAX-I-METER**

The MAX-I-METER method for this operating company eliminated all overtime work because the instruments could be removed and re-installed during regular working hours — no overtime costs — a lineman and groundman alone made these 18 new test installations per day. The time and cost savings were extended to the office because office analysis was simplified since actual peak demand values were obtained.

**You can save with MAX-I-METERS**

You may have numerous transformer banks on your lines that are not fully loaded—you may have others that are overloaded. Both of these situations can remain unknown for too long a time. As a result, it is obvious that service and maintenance costs are too high. If you knew the situation you could switch the transformers of low capacity for those of higher capacity.
Routine transformer checking would keep you informed of the load conditions on your lines and bring you savings which experience shows amounts to worthwhile dollars.

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The MAX-I-METER is a modern, lightweight, weatherproof, maximum-demand ammeter combined with a multi-range split core current transformer—4 ratios —which clamps over the conductor. No connections to make. No trailing leads. Ready for instant use—no support necessary. Accurate to 3% plus or minus. Not affected by ambient temperature. Can be easily reset and used immediately.

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Hot Rolled Copper Rods • Bare and Tinned Strand
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## Sales Opportunities

CHICAGO, ILL.—Commonwealth Edison Co. has taken out permit for extensions and improvements in power substation at 4680 North Lincoln Avenue and will proceed with work at once. No estimate of cost announced.

WATERTOWN, S. D.—City Council receives bids until December 9 for extensions and improvements in municipal power plant, including new 3000-kw. steam turbine-generator unit, condenser and auxiliary equipment. Ralph D. Thomas & Associates, Inc., 100 Second Avenue South, Minneapolis, Minn., is consulting engineer.

BONNEVILLE, ORE.—United States Engineer Office, Bonneville, receives bids until November 29 for 15-kv. metalclad circuit breakers (Circular 122).

SHARON, PA.—Sharon Steel Corp. plans installation of motors and controls, switchgear, transformers and accessories, duct lines, industrial lighting facilities, conveyors, electric hoists and other equipment in connection with expansion in plant for considerable increase in present capacity. Also will install an electric furnace of about 20 tons capacity and auxiliary equipment in branch mill at Lowellville, Ohio. Entire project will cost close to $1,000,000.

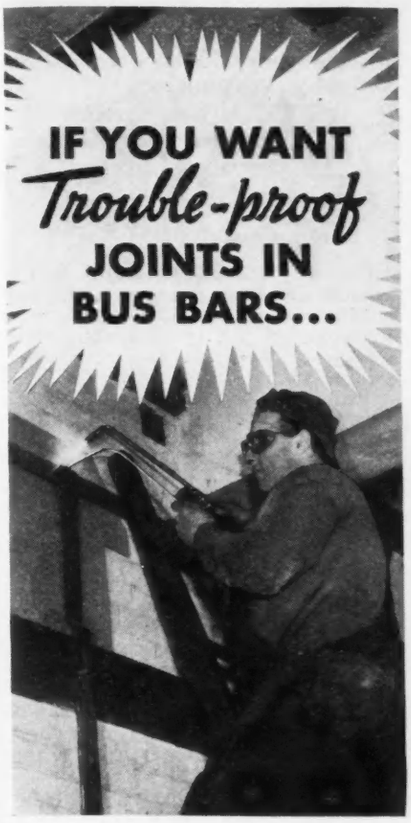
OLYMPIA, WASH.—State Capitol Committee, Public Lands-Social Security Building, Albert C. Martin, secretary, receives bids until November 26 for extensions and improvements in boulevard lighting system on State Capitol grounds. Joseph H. Wohleb, Olympia, is architect.

PALM BEACH, FLA.—Florida Power & Light Co., Miami, plans extensions and improvements in power substation near Pahokee, vicinity of Palm Beach, including installation of transformers, switchgear and auxiliary equipment for increased capacity. Also will rebuild and improve distribution system at Pahokee, with line extensions in that area. Work is scheduled to be carried out at once.

KEWAUNEE, WIS.—City Council is considering extensions and improvements in municipal power plant, including installation of equipment for increased capacity. Estimates of cost are being made.

HOUSTON, TEX.—Humble Oil & Refining Co., Humble Building, plans installation of motors and controls, switchgear, conveyors, duct lines, electric-operated pumping machinery, transformers and accessories, duct lines, conveyors and other equipment in new plant on site adjoining oil refinery at Baytown, Tex., to be used for production of toluol, a petroleum by-product used in manufacture of explosives. Plant will be known as Baytown Ordnance Works and will consist of group of large one and multi-story buildings; output will be for Federal Government, which will provide funds for project over a term of months. Cost estimated about $10,700,000. Company also will install similar equipment in connection with expansion at Baytown oil refining plant, to be carried out at same time, to provide raw material capacity for toluol plant noted. Cost about $1,000,000.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until December 2 for 13 230-kv., 1200-amp., disconnecting switches and for six 230-kv., 1200-amp. oil circuit breakers, for Grand Coulee

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Try this labor-saving, low-cost SIL-FOS brazing method next time you have any bus bar joining to do. As a starter, write today for Bulletin EW-511.

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hydroelectric power plant, Grand Coulee, Columbia Basin project, Wash. Equipment will be installed by Government (Specifications 939).

LOUISVILLE, KY.—Kentucky Utilities Co., Louisville, has authorized plans for new steam-electric generating station in vicinity of High Bridge on Kentucky River, with installation to include turbine generator units with initial capacity of 25,000-kw., high-pressure boilers and complete auxiliary equipment. Large switchyard will be built for connection with Eastern power transmission system of company, as well as with high-tension lines to Louisville. A number of extensions will be made in transmission lines in different parts of system. Entire project is reported to cost about $3,000,000 and is scheduled for completion in 1942.

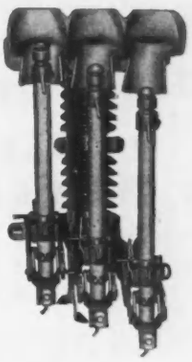
KEARNEY, NEB.—State Board of Control, Lincoln, is considering construction of a steam-electric generating plant for service at State Industrial School, Kearney, as recommended in report of Fred R. Dickson, superintendent at school.

PORTLAND, ORE.—Administrator, Bonneville Project, Department of Interior, Guardian Building, Portland, receives bids until November 25 for 898 steel transmission towers of various types, with leg extensions, anchors, stubs and special structures, for new 230-kv. transmission line from Grand Coulee hydroelectric power development, Grand Coulee, Wash., to Covington, Wash., 183 miles, where connection will be made with Bonneville transmission system (Circular 1522). Fund of $3,850,000 has been authorized for entire project, recently referred to in these columns. Administrator has rejected bids recently received for 115-kv. transmission line from Midway to Hanford, Wash., where power substation will be located; call for new bids will be made soon, with mileage of lines extended (Circular 1404).

BURLINGTON, IOWA—Day & Zimmermann, Inc., Packard Building, Philadelphia, Pa., consulting engineer, has received contract from War Department, Washington, D. C., to design new shell-loading plant to be constructed on site near Burlington, where tract of about 20,000 acres of land is being acquired by Government. Award includes supervision of erection, installation of equipment and operation, and totals $34,451,384. Plant will comprise a series of one and multi-story buildings, with power house, pumping station, shops, administration building and miscellaneous structures. Installation will include motors and controls, switchgear, transformers and accessories, duct lines, exterior night-lighting facilities, interior industrial lighting equipment, conveyors, electric hoists and other equipment, in addition to power station apparatus. Of gross sum noted, approximately $15,000,000 will be expended for plant, machinery and equipment, and operating facilities. Work is scheduled to be placed under way soon.

JOHNSTOWN, PA.—Pennsylvania Electric Co. plans extensions and improvements in underground system in downtown district, including installation of new conduits in Locust Street and other thoroughfares, underground transformer vaults and other facilities.

WASHINGTON, D. C.—General Purchasing Officer, Panama Canal, Washington, receives bids until December 13 for a number of pumping units for dewatering service (Schedule 4508).

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# LETTERS TO THE EDITOR

## *Rate Reductions by Dividend*

*To the Editor of* ELECTRICAL WORLD:

The editorial in the October 19, 1940, issue of the ELECTRICAL WORLD entitled "Rate Reductions by Dividend" causes us to bring to your attention the advocacy of this plan by Chairman Alfred C. Davis, Chairman of the Board of Public Utilities, to the New York State Constitutional Convention on June 29, 1938.

Mr. Davis is a graduate electrical engineer (University of Pittsburgh), formerly chief engineer of the Fort Wayne, Ind., division of the Pennsylvania Railroad and at present president and general manager of the Marlin-Rockwell Corporation, one of the leading manufacturers of ball bearings in the United States, as well as chairman of the executive committee of the Art Metal Construction Company, the world's largest manufacturer of metal furniture.

The Jamestown municipal electric system, under the direction of Mr. Davis, placed the Consumers' Dividend Plan into operation in 1939. The plan is incorporated in the Schedule for Electric Service on file with the New York Public Service Commission. A copy of Rule 29 of this filed rate schedule describing the plan now in effect in the territory served by the Jamestown municipal electric system is inclosed.

On October 15, 1940, the Board of Public Utilities of the city of Jamestown adopted a resolution making effective a 20 per cent consumers' dividend on purchases of electricity during the dividend year October 1, 1939, to September 30, 1940.

T. J. MCKEE, Secretary
Municipal Electric Utilities Association, Jamestown, N. Y.

**Rule 29**

**Consumers' Dividend Plan**

The rates and charges stated in this schedule are subject to an annual dividend based on the earnings of the utility for the twelve months ending September 30 of each year. The total amount of such dividend will be determined by the Board of Public Utilities as soon as practicable after the close of the dividend year after reasonable reserves have been established for contingencies. The total amount of such annual dividend applicable to consumers served under service classification rates will be apportioned as follows: The amount to be refunded will be expressed as a percentage of the total electric service revenues at service classification rates in the dividend year. The dividend payable to each consumer will be determined by multiplying the sum of the charges to him during the dividend year by this percentage. A check for the resulting amount will be mailed to the address of record of each consumer unless his account is in arrears, in which case the dividend will be credited to the account.

•

## *Dividend Rate Reductions*

*To the Editor of* ELECTRICAL WORLD:

Referring to your editorial in the October 17 issue of the ELECTRICAL WORLD relative to the possibility of using a Customer Dividend Policy, I enclose a table covering the experience of The Hartford Electric Light Company in this respect.

We have found that the fears you enumerate, as well as many more, are all imaginary.

You do not mention the greatest ad-

**Customer Dividend Record The Hartford Electric Light Company**

| Year | Percentage | To customers | To employees | To stockholders | Total |
|---|---|---|---|---|---|
| 1925 | 50 | $221,519.91 | 0 | 0 | $221,519.91 |
| 1926 | 60 | 283,830.30 | 0 | 0 | 283,830.30 |
| 1927 | 40 | 185,976.51 | 0 | 0 | 185,976.51 |
| 1928 | 60 | 333,174.16 | $72,214.67 | $90,000.00 | 495,388.83 |
| 1929 | 60 | 341,669.87 | 77,088.47 | 99,000.00 | 517,758.34 |
| 1930 | 40 | 227,202.30 | 56,166.85 | 77,000.00 | 360,369.15 |
| 1931 | 10 | 55,060.02 | 13,427.26 | 18,844.40 | 87,331.68 |
| 1932 | 40 | 171,051.81 | 0 | 0 | 171,051.81 |
| 1933 | .... | 0 | 0 | 0 | ..... |
| 1934 | .... | 0 | 0 | 0 | ..... |
| 1935 | .... | 0 | 0 | 0 | ..... |
| 1936 | .... | 0 | 0 | 0 | ..... |
| 1937 | April 40 | 227,096.00 | 0 | 0 | 227,096.00 |
| 1937 | Oct. 20 | 112,533.55 | 30,810.34 | 35,594.18 | 178,938.07 |
| 1938 | .... | 0 | 0 | 0 | ..... |
| 1939 | 25 | 189,509.17 | 39,399.06 | 48,178.47 | 277,086.70 |
| 1940 | July 20 | 142,000.00 | 32,000.00 | 38,000.00 | 212,000.00 |
| 1940 | Dec. 20 (Est.) | 168,000.00 | 32,000.00 | 38,000.00 | *238,000.00 |
| | | $2,658,623.60 | $353,106.65 | $444,617.05 | $3,456,347.30 |

* Basis of distribution.

| | | | |
|---|---|---|---|
| To customers: | 20% | Discount on December bills | Est. $168,000 |
| To employees: | 20% | Increase in wages for Dec. | Est. 32,000 |
| To stockholders: | 20% | Of one month's Dividend (accrual) | Est. 38,000 |
| | | | (Est.) $238,000 |

Globar
REG. U. S. PAT. OFF.

*A monthly meeting place for news and views about High Temperature Electric Heat*

WOULD you like to know how an internationally famous tool manufacturer heat treated a set of high speed steel thread rolling dies that turned out 14,650,000 bolts?

These dies were made from high speed steel hardened in a "Globar" Equipped High Temperature Electric Furnace with atmosphere control. The steel of course is important, but the heat treating is the reason for the phenomenal life of these thread rolling dies. It should be noted that these particular dies were not in any sense special because they were taken from a regular production run of tools.

With one of the best engineering staffs to be found anywhere this manufacturer in its 70-odd years of experience has accumulated a tremendous fund of information on heat treating tools. Its adoption, then, of electric heat is significant. And it is significant, too, that in its quest for a tool of the highest possible quality it adopted furnaces with Globar Brand High Temperature Heating Elements as standard equipment.

Experience has proved that these furnaces reduced manufacturing costs, but that is a secondary consideration with a manufacturer whose primary interest is quality of product.

If you use high temperatures, we will be glad to undertake to help you improve the quality of your product and lower your production costs. Or if you are in the utility business you undoubtedly have customers who can profit from the same information. Drop us a line today!

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vantage of all, namely, to retain a high earning power in the rate level without collecting an excess income in good years. You will note the comfortable margin of earning power with which we entered the period of depression as well as the fact that we obtained the effect of a rate increase through the omission of the dividend at a time when rate increases were psychologically out of the question.

Years of experience have convinced me of the soundness of the policy, an essential detail of which is a variation of the percentage from year to year.

The inclusion of employees and stockholders is interpreted by the public as evidence of true profit sharing.

S. FERGUSON, President
Hartford Electric Light Company,
Hartford, Conn.

•

## American Steel Honors Long-Service Employees

Faithful service by 217 employees was recognized by the American Steel & Wire Co. at a recent luncheon at its American Works in Cleveland. The employees, who have service records ranging from 25 to 50 years and totaling 6,425 years, were awarded U. S. Steel Corp. service medals.

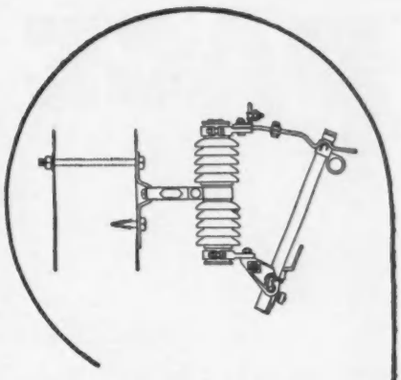
The two veterans with the longest records are Edward C. Fricker and Fred Y. Koenig, each of whom received a gold 50-year medal. Included in the group receiving awards were several officials of the company, including H. B. Jordan, vice-president in charge of operations; S. Dunlap, auditor; G. H. Rose, chief engineer; H. J. Weeks, manager of safety, casualty and pensions; P. T. Coons, manager of electrical wire rope and construction materials sales; A. G. Montgomery, assistant chief engineer, and Donald Knepper, Cleveland district director of industrial relations.

•

## Chicago Edison Issues Report on Conversions

A total of $1,427,400 of Commonwealth Edison 3½ per cent debentures has been converted into Edison common stock since September 1, Chairman Charles Y. Freeman announced recently. To date, an aggregate of $98,456,300, or 76 per cent, of the $129,431,400 of debentures originally issued has been converted, leaving a balance outstanding of $30,975,100.

Debenture holders who converted into Edison stock and were stockholders on October 11 received the dividend of 45 cents a share November 1, having foregone accrued interest since July 1 on the debentures converted.



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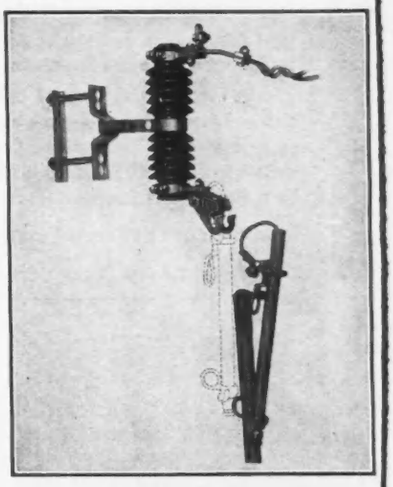
Fuseholders can't be installed backwards.

Fuseholders won't weld to upper arm during heavy short circuit.



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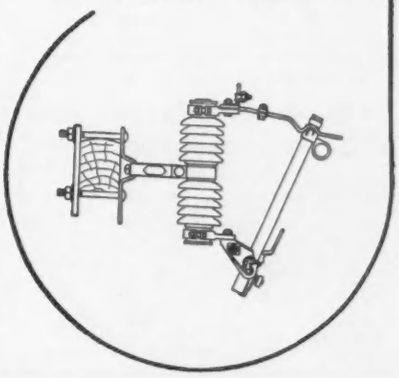

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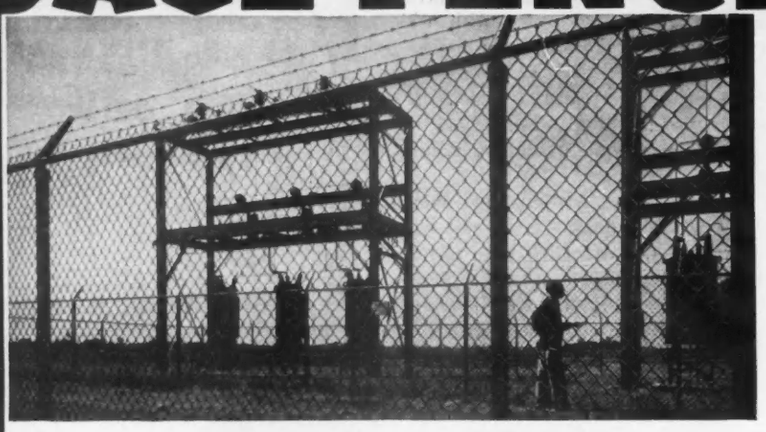

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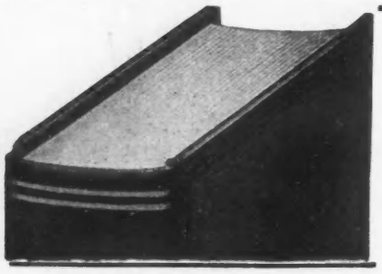

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## Recent Rate Changes

PEOPLES POWER CO. has reduced its electric rates $214,200, effective November 1, Acting Chairman William W. Hart of the Illinois Commerce Commission has announced following a series of informal conferences with company officials. All residential customers, urban and rural, will receive aggregate annual savings of $88,200, an average cut of 10.3 per cent. Reductions in commercial lighting rates total $74,300 per year and average 11.8 per cent; this cut in commercial lighting charges extends to the entire territory served by the company. The remaining $51,700 of the $214,200 total reduction applies primarily to large power users and to municipal lighting and power services, other than street lighting, in Moline, East Moline, Rock Island and Silvis. Commissioner Harper stated that all communities and rural areas served by the company would obtain lower rates and that the percentage of reduction to residential and commercial lighting customers represented one of the most substantial cuts effected in recent years. The following cities, towns and villages are served by the company: Moline, East Moline, Rock Island, Silvis, Milan, Barstow, Campbell's Island, Carbon Cliff, Cleveland, Colona, Cordova, Hampton, Hillsdale, Joslin, Port Byron and Rapids City.

SOUTHWESTERN PUBLIC SERVICE CO. has announced a reduction in electric rates for Roswell and Pecos Valley communities served by the company. The new schedules, which benefit both residential and commercial customers, are now in effect. The top rate for lighting is now 6 cents per kilowatt-hour, as compared to 7 cents before the reduction. In commenting on the new schedule, Henry E. Samson, district manager, said: "This new rate reduction is merely in line with our long-established policy of reducing rates as rapidly as possible, consistent with the furnishing of dependable service. We are pleased that the greater usage of electric service makes this lower rate possible. . . ."

CANTON ELECTRIC LIGHT & POWER CO. has been granted permission by the New York Public Service Commission to put into effect revised rates for all-purpose use which will result in savings of approximately $3,300 per annum to electric consumers. The all-purpose classification includes commercial and industrial use. The new schedule went into effect November 10. The reductions will affect consumers using in excess of 250 kw.-hr. per month.

CAROLINA POWER & LIGHT CO. has announced a reduction of one-half cent per kilowatt-hour in its rates to home users of electrical water heaters. It is also reducing its rates to large industrial and commercial users of power. The new schedule of rates, to go into effect on December 15, will save power consumers in North and South Carolina approximately $283,000 per annum.

EDWARDS LIGHT & POWER CO. has been granted permission by the New York Public Service Commission to put into effect revised rate schedules which will result in savings of approximately $600 to electric consumers. The revisions will be applicable in the village and town of Edwards, St. Lawrence County. The new and old rates for residential service may be compared as follows: The initial charge is reduced from $1 to 95 cents per month and the allowance of electricity in the minimum is increased from 11 to 12 kw.-hr. per month. In the all-purpose classification which ap-

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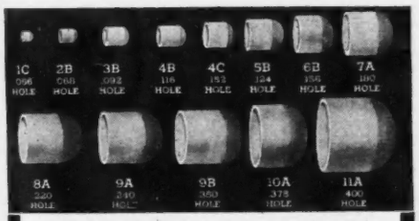


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plies to commercial and small industrial use the energy charge is reduced from 8 to 7 cents per kilowatt-hour for the first 50 kw.-hr. per month.

PENNSYLVANIA PUBLIC UTILITY COMMISSION in the biennium ending May, 1940, made rate reductions which saved Pennsylvania consumers $8,175,435 annually, the commission recently announced. Largest of the rate cuts were: Pennsylvania Power & Light, $2,296,737; Duquesne Light, $1,724,000; Philadelphia Electric, $1,659,700 and Edison Light & Power, York, Pa., $424,462.

HUBBARD, OHIO, Board of Public Affairs has announced reduction in rates to save consumers an estimated $6,000 a year, effective with December 1 billings. The new schedules were made possible by a new contract with the Ohio Edison Co. and a $15,000 surplus in the light department. Hubbard purchases the power from the Ohio Edison and distributes the energy over village lines.

BRYAN, OHIO, Board of Public Affairs has put into effect a new electric hot water heating rate. The rate will be 1½ cents per kilowatt-hour, with a minimum charge of $1. Discount of 20 per cent is provided for prompt payment.

PUBLIC ELECTRIC LIGHT CO. of St. Albans, Vt., has filed with the state Public Service Commission a revised wholesale energy contract with the City of Burlington. This contract, effective September 1, 1940, with annual savings to Burlington of $6,758 based on 1939 purchase of 11,200,000 kw.-hr., is as follows: Charge per month—Demand (60 minute) first 500 kw., $1 per kilowatt; all over 500 kw., 50 cents per kilowatt. Energy, first 100,000 kw.-hr., $1.25 per kilowatt-hour, next 400,000 kw.-hr., $1 per kilowatt-hour; all over 500,000 kw.-hr., 45 cents per kilowatt-hour. The old contract was for one cent per kilowatt hour for all energy purchased. Since the City of Burlington purchases over 500,000 kw.-hr. each month, all increased use will be at approximately ½ cent per kilowatt-hour under this contract, compared with 1 cent per kilowatt-hour under the old contract.

•

## Municipal Plants

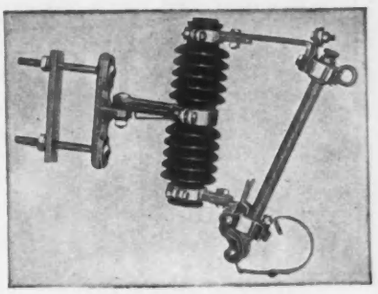
FOSSTON, MINN.—Voters at a recent election voted 487 to 148 for construction of a municipal light and power plant. The twenty-year franchise of the Interstate Power Co. expires on November 29.

ENDERLIN, N. D.—At a special election held recently, citizens rejected a proposal of the City Council to sell $182,000 in revenue bonds, proceeds of which were to be used for construction of a municipal power plant. Otter Tail Power Co. now holds the franchise.

•

## REA Power Plant

REA has given instructions for the construction of the proposed new generating plant of the Minnkota Power Co-operative at Grand Forks, N. D. The plant is to be built on a cost plus basis, with the co-operative buying the material and asking lowest bids from contractors on labor costs. Plans call for a modern structure 320 x 75 ft. in ground dimensions.

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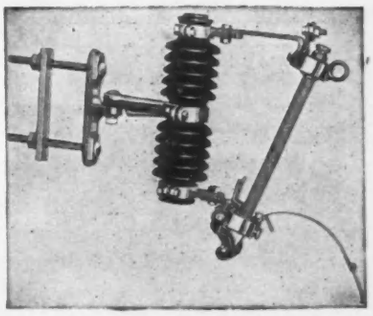

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Bus & Cable Connectors
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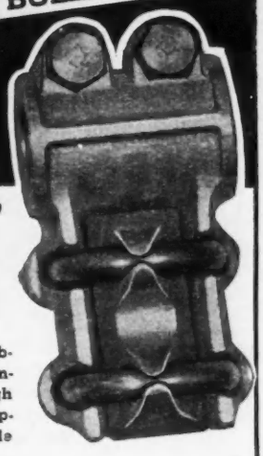

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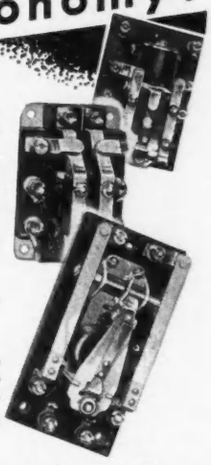

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Made right - Priced right - Adapted to your needs

## Economical 3-Phase to 2-Phase Conversion

[*Continued from page 64*]

using its 2,400-volt connection and continuing in two-phase operation as before. In this way each bank was changed without disturbing the customer, and shortly all banks in the city had one old 2,400/480-volt transformer and one new transformer hooked up 2,400/480 volts, but easily changed to 4,160/480 by a simple change of taps. Finally, each feeder was cut over in the wee small hours of a Sunday morning by disconnecting the two-phase source, shifting new transformers to the 4,160 tap and throwing back on to the new three-phase source.

In the conductor arrangement, as the diagram indicates, the two-phase, four-wire lines A-B, A′-B′ were cut over so as to become A-N-B-C of the three-phase, four-wire system and the old 2,400-volt transformer on A-B of the two-phase circuit became A-N on the new without any change whatever. Similarly the new transformer first operated at 2,400 volts on A′-B′ of the two-phase line and became B-C at 4,160 volts across phase wires when changed over. From the vectors given in the diagram it will be seen that this produces a satisfactory two-phase secondary voltage.

Naturally there is some unbalance of current in primary conductors at each bank, since one-half the load is at 2,400 volts and the other half is at 4,160 volts, but by balancing off other banks and considerable single-phase load it was found possible to maintain satisfactory feeder balance. The new system has been in service for about one year and is doing a good job so far.

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High and Low Voltages

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WESTERN RED CEDAR
The pole with extended service life above the ground

Sapwood of DURAPOLES machine shaved and treated . . .

TWO OPERATIONS TO PREVENT SAPROT

Each DURAPOLE has been machine shaved to insure a maximum limit of sapwood thickness above the ground line. The sapwood is reduced to less than ½" in thickness. This inhibits fungus growths that start in the thick sapwood areas of poles. Longer pole life is the result. Sterilization of the surface of the remaining sapwood is accomplished by full length immersion in heated Grade #1 AWPA special creosote; a further prevention against sapwood decay. In addition to these important means of extending pole life is the undeniable advantage to customer good will resulting from a marked improved appearance.

You get all these features when you specify DURAPOLE

*Slab Gained* — for perfect drainage, for secure arming — for much better appearance.

*Full length treated* — for sterilization of sapwood — for uniform light brown permanent color — for attractive appearance.

*Butt treated ½" guaranteed penetration* — no reduction of sapwood in butt section.

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# REA Allots Funds; New Contracts Let

During the first week of November the Rural Electrification Administration made allotments totaling $7,173,000. Among these allotments were funds for the establishment of new co-operatives and a public utility district in the state of Washington and the enlargement of existing rural power systems in various sections of the country.

Tri-State Power Co-operative at La-Crosse, Wis., received $1,100,000. This system in the past received allotments totaling $1,500,000 for the construction of a steam-generating plant at Genoa. The new funds provide for the installation of two additional 4,000-kw. turbo-alternating units, construction of a tie-line between the Genoa plant and the Trempealeau substation of the Wisconsin Power Co-operative, overheads, and installation of necessary auxiliary and electrical equipment.

Among the other allotments were the following:

ALABAMA — Tallapoosa River Electric Membership Corp., Lafayette, James F. Bevis, supt., $240,000 to build 391 miles of line, 1,142 members in Chambers, Randolph, Clay, Tallapoosa, Lee and Russell Counties.

ARIZONA—Sulphur Springs Valley Electric Co-operative, Inc., Willcox, Mike M. Bennett, supt., $165,000 to build and acquire 164 miles of line, 347 members in Cochise and Graham counties.

ARKANSAS—Ozarks Rural Electric Co-operative Corp., Fayetteville, E. H. Looney, supt., $168,000 to build 180 miles of line, 576 members in Washington and Madison counties, Ark., and Adair and Sequoyah counties, Okla.

COLORADO—Yampa Valley Electric Co-operative, Inc., Steamboat Springs, Colo., Perry Clark, president, $152,000 to build 185 miles of line, 373 members in Routt County.

GEORGIA—Habersham Electric Membership Corp., Clarkesville, E. A. Lunceford, supt., $158,000 to build 164 miles of line, 623 members in Habersham, Stephens, Rabun, White and Hall counties.

INDIANA—Clark County REMC, Sellersburg, Paul E. Smith, supt., $54,000 to build 59 miles of line, 180 members in Scott, Clark, Floyd and Jefferson counties.

IOWA—Nyman Electric Co-operative, Inc., Stanton, Oscar Wenstrand, president, $135,000 to build 149 miles of line, 379 members in Page and Montgomery counties.

KENTUCKY—Licking Valley Rural Electric Co-operative Corp., West Liberty, A. C. Elkins, co-ordinator, $137,000 to build 140 miles of line, 545 members in Morgan, Breathitt, Magoffin and Wolfe counties.

LOUISIANA — Washington-St. Tammany Electric Membership Corp., Franklinton, S. J. McMahon, supt., $87,000 to build 121 miles of line, 336 members in Washington, St. Tammany and Tangipahoa Parishes.

MINNESOTA—North Star Electric Co-operative, Inc., Baudette, Clarence Peterson, co-ordinator, $196,000 to build 228 miles of line, 538 members in Lake of the Woods, Koochiching and Roseau counties.

MISSOURI—Sac-Osage Electric Co-operative, Inc., Stockton, Henry C. Cowan, president, $152,000 to build 158 miles of line, 380 members in Cedar, Dade, and Vernon counties. Crawford Electric Co-operative, Inc., Bourbon, Robert L. Mook, president, $295,000 to build 325 miles of line, 1,021 members in Crawford, Franklin and Gasconade counties.

NEW HAMPSHIRE—New Hampshire Electric Co-operative, Inc., Plymouth, Leon M. Huntress, supt., $412,000 to build 336 miles of line, 866 members in Grafton, Merrimack, Rockingham, Carroll, Belknap, Strafford and Sullivan counties.

OHIO—Pioneer Rural Electric Co-operative, Inc., Piqua, A. E. Halterman, supt., $96,000 to build 28 miles of line, 91 members in Miami, Logan, Shelby and Champaign counties.

OKLAHOMA—East Central Oklahoma Electric Co-operative, Inc., Okmulgee, D. A. Turinsky, supt., $144,000 to build 186 miles of line, 648 members in Tulsa, Seminole, McIntosh, Creek, Okmulgee, Okfuskee, Muskogee and Cherokee counties.

PENNSYLVANIA—Tri-County Rural Electric Co-operative Assn., Mansfield, M. S. Whitlock, supt., $117,000 to build 102 miles of line, 397 members in Tioga, Potter, Lycoming and Bradford counties.

TEXAS—Wood County Electric Co-operative, Inc., Quitman, V. B. Shaw, supt., $54,000 to build 124 miles of line, 425 members in Van Zandt, Smith, Wood, Titus, Hopkins, Upshur and Franklin counties.

VERMONT—Washington Electric Co-operative, Inc., East Montpelier, Capt. Clarke Millen, supt., $28,000 to complete a section of the system.

VIRGINIA—B.A.R.C. Electric Co-operative, Millboro, M. R. Seabrooke, supt., $275,000 to build and acquire 212 miles of line, 1,101 members in Rockbridge, Bath, Highland, Alleghany and Augusta counties.

WASHINGTON—Skamania County Public Utility District No. 1, Carson, (Personnel to be appointed), $28,000 to build 31 miles of line, 126 members in Skamania County.

WISCONSIN—Wisconsin Power Co-operative, Chippewa Falls, Edward B. Wayts, supt., $350,000 for additional generating facilities.

Construction contracts approved between October 7 and October 23 were recently announced by REA. Among the contracts were the following:

ALABAMA—Southern Pine Electric Membership Corp., Brewton, Ala., Joseph T. Larkins, supt., and Gordon Persons & Co., Inc., Montgomery, Ala., engineer, contract to Montgomery Electric Co., Montgomery, 138 miles of line, 404 members; bid $87,323.

COLORADO—High Line Electric Assn., Holyoke, Colo., T. G. Puryear, supt., and Rocky Mountain Engineering Co., Denver, Colo., engineer, contract to E. A. Reither, Aitkin, Minn., 185 miles of line, 418 members; bid $127,823.

GEORGIA — Rayle Electric Membership Corp., Washington, Ga., Wilfred B. Smith, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Roy Richards, Carrollton, 445 miles of line, 967 members; bid $227,574.

IDAHO—Clearwater Valley Light & Power Assn., Lewiston, A. R. Mushlitz, supt., and R. W. Retherford, Lewiston, Idaho, engineer, contract to Homer G. Johnson, Portland, Ore., 73 miles of line, 105 members; bid $53,723.

MINNESOTA—Douglas County Co-operative Light and Power Assn., Alexandria, Clifford R. Hove, supt., and General Engineering Corp., Minneapolis, Minn., engineer, contract to Acme Construction Co., St. Paul, Minn., 456 miles of line, 741 members; bid $263,038.


# SEARCHLIGHT SECTION

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To take charge of 50,000 k.w. base-load high-pressure plant in Middle West city. Write full details of experience to

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## POSITION VACANT

*(See also "Selling Opportunities Offered")*

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## EMPLOYMENT SERVICE

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**(Continued on the opposite page)**